

# BRITISH JOURNAL OF TUBERCULOSIS AND DISEASES OF THE CHEST

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## EDITORIAL

### THE NEW AGE IN MEDICINE

Our times demand new measures and new men,  
The world advances and in time outgrows  
The laws that in our fathers' day were best,  
And doubtless, after us, some purer scheme  
Will be shaped out by wiser men than we.

J. R. LOWELL.

FESTIVAL is in the air and festival programmes, scientific and otherwise, are manifold: moreover, centenaries recur but once in the normal span of human life and only then if we happen to be of the generation in which they fall. We, all of us, hope that this year of 1951 will be as memorable a year as the Great Exhibition year of 1851. It is, therefore, no less than right and fitting that this journal, now in its 45th year, should mark so great and auspicious an occasion by publishing a "Festival Number."

Many of us, inspired by that great clinician the late Professor John Ryle, to whom medicine owes so much, have for long shared his belief that the field of vision of clinical medicine must be enlarged and opportunities for etiological studies augmented. In the last years of his life he never ceased to lament that "we are still, as a profession, thinking more about medical care and its huge costs than about the economies which could be effected by attacking the basic causes of disease. Medical education and research have lost to a disturbing degree that sense of direction and of realism which is essential to the vitality of all applied sciences." He believed that the constantly changing social order demanded changing disciplines.

Nevertheless, some of us did not share his views, well grounded though they must have been, of making social medicine a speciality, rather than integrating it with general medicine. Many of us whose principal interest is in diseases of the chest, and particularly in pulmonary tuberculosis, have regarded "the whole man and his family, his relation to society and his home and working environment," as our first concern.

Pulmonary tuberculosis does, in fact, serve as a barometer of the health of the community which can be regulated only by complete unification of all preventive and therapeutic services. For the control of this disease prevention, care, and after-care (including health education of the public, mass radiography, control of milk supplies, diet, B.C.G. vaccination, examination of contacts, housing schemes and a complete scheme for rehabilitation) are no less import-

ant than adequate facilities for domiciliary and institutional treatment of the tuberculous individual according to a basic sanatorium régime, reinforced, where indicated, by chemotherapeutic, collapse and other surgical measures.

In our last issue Professor Heaf discussed the problem of tuberculous infection and disease. It is true that we can bring some control to bear upon infection and we can also treat the individual sufferer from disease, but our constant aim must be to increase the gap between infection and disease. In this connection social and economic factors, often admittedly beyond the control of our profession, are outstandingly important. In the words of Professor Cameron in a recent address, "Good conditions of life make for high resistance to disease, and these are things which even a national tuberculosis service cannot bring about."

In certain respects the service as it existed before July 1948 had points to commend it: then at least there was unified control under the local authority of the preventive and therapeutic services, instead of the former being under the Regional Boards acting for the Ministry and the latter under the local authority. Moreover, the Emergency Medical Service had played an important part in the inauguration of regional chest units. On the other hand, the quality of the work varied with each authority, and the clinician in charge was by no means unfailingly recognised as a specialist in his subject. In fairness, however, his present improved status must in no small measure be attributed to the National Health Service, which is enabling him to establish in-patient facilities in general or fever hospitals in addition to sanatoria, thus linking the out-patient Chest Clinic to the in-patient Chest Unit and leading to closer association with the general hospital. In consequence the post of chest physician can now attract men and women of high calibre who, in addition to their specialised experience in tuberculosis and diseases of the chest, have already had a good initial training in general medicine.

In our last issue we published a report of the Ministry of Health which noted the provision of more beds and additional nurses, thus satisfying some of the criticisms justifiably levelled against the service. Certain it is that tuberculosis is now regarded as an A1 priority, and there is every reason to suppose that closer co-operation between the Medical Officer of Health and the Chest Physician should dispel the disadvantages of dual control.

Turning aside for the moment from pulmonary tuberculosis, our attention is drawn to the alarming increase in cancer of the lung, for which the reported number of deaths in England and Wales in 1949 was 11,272, as compared with 612 in 1922. Its predominance among males, especially between the 40 and 60 age period, and its relationship to smoking, widely reported in this country and in the United States, are problems of social medicine demanding further etiological studies. Among other problems that require further research there are the pneumoconioses, the changing pattern of the pneumonias, the medical treatment of many forms of pulmonary suppuration and empyema, chest disease in old age, and the various pulmonary manifestations of systemic disease. The Pneumoconiosis Research Unit in Wales is a favourable portent for the future.

The new age in medicine, notably in relation to pulmonary tuberculosis and diseases of the chest, does, however, presuppose some degree of specialisation which must not, at any cost, preclude a wide embrace of the subject in relation

to an integrated social and clinical medicine. Without such specialisation it is humanly impossible for the newer technology to develop, involving as it does progress during the last twenty years in the fields of diagnostic radiology (including tomography, bronchography and angiocardiology), radiotherapy, knowledge of the anatomy of the bronchi and broncho-pulmonary segments, respiratory mechanics, anaesthesia, and, above all, surgery of the chest.

In this issue of our Journal Mr. Holmes Sellors has reviewed the progress of his speciality, thoracic surgery, during the past half-century. It is significant that he should plead strongly for a conservative approach to surgery and that, as a surgeon, he should emphasise the need for a basic pre-operative and post-operative sanatorium régime for certain cases, based on team work between physician, surgeon, radiologist, anaesthetist, physiotherapist and occupational therapist. His article recalls the salutary advice given by Sir Robert Young in his Lumleian Lectures in 1927 on a "Medical Review of the Surgery of the Chest."

From another point of view Sir Arthur MacNalty reviews the progressive control of pulmonary tuberculosis that has taken place, and his position for many years at the head of administrative affairs enables him to write with unique authority. His conclusions are indeed reassuring, and it would be churlish to question his final statement that the high standard reached in clinical and preventive work must at the very least be maintained if further progress is to be made. Other contributors deal with current problems of clinical significance.

It is, however, the future that we must chiefly consider. Our opportunities for clinical and experimental research are unlimited. The establishment of the National Health Service has led to the formation of Chest Units throughout the country where a high standard of medicine and surgery has made a valuable contribution to British medicine. The road ahead is posted with hopeful and encouraging signs, and if, as Dr. T. F. Fox in his recent Croonian lectures has emphasised, the need for the preservation of professional independence, initiative and responsibility is recognised and the administrators in the National Health Service will, as *The Times* has suggested, "provide a soil in which professional freedom can flourish and Medicine and the State can live in comfort with each other," then, indeed, the doctor's freedom will be the greater and the prognosis the more favourable.

As far as this Journal is concerned we hope to broaden its scope by inviting colleagues from the Dominions to serve on our editorial board. This will probably involve an increase in the size of the Journal and, as a consequence, an inevitable rise in its cost. We hope, thereby, to be able to present to our readers the most recent developments accruing from socio-clinical and other researches in tuberculosis, diseases of the chest and cognate subjects.

## GENERAL ARTICLES

THE CONTROL OF PULMONARY TUBERCULOSIS  
IN ENGLAND

BY SIR ARTHUR S. MACNALT, K.C.B.

Formerly Chief Medical Officer, Ministry of Health

TUBERCULOSIS is a disease of respectable antiquity and has long been with us. In the seventeenth century Richard Morton noted the great prevalence of tuberculosis of the lungs in this country, for in his *Phthisiologia*, the first systematic treatise of consumption, published in 1689, he writes:

"Yea, when I consider with my self how often in one year there is cause enough ministered for producing these swellings, even to those that are wont to observe the strictest rules of living, I cannot sufficiently admire that any one, at least after he comes to the Flower of his youth, can dye without a touch of a consumption."

This antedates by 200 years Virchow's dictum that everyone shows, at last, some trace of tuberculosis.

The infectious nature of tuberculosis was recognised by Hippocrates, Galen, Avicenna, Ballonius, Morgagni and others, but in the early part of the nineteenth century English medical opinion inclined to the view that it was non-infectious and the manifestation of a special constitution or diathesis. This erroneous belief disappeared in the light of Villemin's researches and the discovery of the tubercle bacillus by Robert Koch in 1882.

## PROGRESSIVE INTEREST OF THE STATE IN TUBERCULOSIS

The interest of the State in tuberculosis dates from the early days of health organisation in England. After Villemin had made his classical communication on the transmissibility of tuberculosis before the Academy of Medicine in Paris, Sir John Simon, then medical officer of the Privy Council, enlisted Sir John Burdon-Sanderson's aid to carry out experiments, which confirmed those of Villemin, and announced the findings in his reports to the Privy Council of 1867 and 1868. Investigation into soil dampness as a predisposing cause of pulmonary tuberculosis was made by Sir George Buchanan, the elder (Ninth and Tenth Reports to the Medical Officer of the Privy Council, 1866 and 1867), and confirmed by the independent work of Bowditch in America. Much research work on tuberculosis was also done by Klein and others for the Local Government Board, including epidemiological as well as scientific investigation.

A further stage in the deepening concern of the State with tuberculosis



was seen in 1888, when the Local Government Board set up a Departmental Committee to consider, among other matters, the best method of checking the progress of the disease in cattle. About this time, also, experiments on the subject of tuberculous meat were made under the direction of the Veterinary Department of the Privy Council (see the annual reports of the Privy Council for 1890 and 1891). Brief allusion may be made also to the Royal Commissions on the effect, if any, of food derived from tuberculous animals on human health. The first of these was appointed in July 1891, with Lord Basing as chairman. On his death the Commission was reconstituted in 1894 under the chairmanship of Sir George Buchanan. It examined many witnesses and organised intensive researches on definite lines. It reported in 1895, the conclusions as to the deleterious effect of the consumption of tuberculous milk being specially important. In 1896 another Royal Commission considered the administrative aspect of the question. Its findings received legislative recognition in the Dairies, Cowsheds and Milkshops Order of 1899.

#### THE ROYAL COMMISSION ON TUBERCULOSIS

In 1901, at the Tuberculosis Congress held in London in that year, Prof. Koch announced in his historical address that he felt "justified in maintaining that human tuberculosis differs in important respects from bovine tuberculosis and cannot be transmitted to cattle." He added that repetition of the experiments which had caused him to make this assertion was desirable; in his opinion, the infection of man by bovine tuberculosis was so rare that for practical purposes it might be ignored. The Government felt the issue to be of such importance that on August 21, 1901, a Royal Commission, with the late Sir Michael Foster as chairman, was appointed to inquire and report with respect to tuberculosis: (1) Whether the disease in animal and man is one and the same; (2) whether animals and man can be reciprocally infected with it; and (3) under what conditions, if at all, the transmission of the disease from animal to man takes place, and what are the circumstances, favourable or unfavourable, to such transmission. The Commission worked for ten years, and published a valuable series of reports which indicated that Koch's statement could not be accepted in its entirety, that human tubercle bacilli infect cattle under experimental conditions, whilst bovine tubercle bacilli are responsible for a considerable proportion of human tuberculosis, especially among children. The subsequent work of W. T. Munro showed that cowmen occasionally contracted pulmonary tuberculosis from tuberculous cattle and that bovine tubercle bacilli were present in the patients' sputa. Stanley Griffith confirmed Munro's findings.

The Commission had set up its own experimental farm and research station at Stansted with a brilliant staff of research workers, which included Dr. A. E. Eastwood, Dr. Louis Cobbett, Dr. Stanley Griffith and Dr. Fred Griffith. At the conclusion of the Commission's work Dr. Cobbett went to Cambridge to write his authoritative book, *The Causes of Tuberculosis*. Dr. Stanley Griffith worked at Cambridge for the Medical Research Committee on the typing of tubercle bacilli, and Dr. Eastwood and Dr. Fred Griffith were appointed pathologists to the Local Government Board.

## VOLUNTARY WORK IN TUBERCULOSIS

Much voluntary work had been done in the treatment of tuberculosis in the nineteenth century. The Brompton Hospital was founded in 1841 and was followed by other chest hospitals in London and the provinces. The Sea Bathing Hospital at Margate treated non-pulmonary tuberculosis. In 1887 Sir Robert Philip began his pioneer dispensary work at Edinburgh in which he emphasised the importance of the examination of contacts and the importance of after-care. Voluntary tuberculosis dispensaries were established later in London, Oxfordshire and elsewhere. George Bodington (1799-82), M.D. Erlangen, L.R.C.P. Edin, as far back as 1840 had advocated and practised the open-air treatment of consumption, but the main impetus to systematic sanatorium treatment came from Germany, especially from the methods employed by Brehmer at Görbersdorf and by Walther of Nordrach. In 1904 the Brompton Hospital Sanatorium was opened at Frimley in association with Brompton Hospital and with Dr. Marcus Paterson as medical superintendent. King Edward VII took a special interest in the prevention and treatment of tuberculosis. The King Edward VII Sanatorium at Midhurst was founded in 1906, and it was largely due to King Edward's encouragement that the National Association for the Prevention of Tuberculosis in 1898 began its beneficent work. Enlightened medical officers of health, like Newsholme, started the treatment of tuberculosis in isolation hospitals.

## NOTIFICATION OF TUBERCULOSIS

All this work was watched by the State with ever-increasing attention. In 1902 Sir William Power instructed Dr. H. T. Bulstrode a medical inspector of the Local Government Board, to visit the public phthisis sanatoria in this country and report upon the various aspects of the sanatorium question. The report, a bulky volume of 670 pages, was published in 1908. In addition to detailed descriptions of English sanatoria, it gave a comprehensive account of the state of scientific knowledge of tuberculosis at that time and considered many aspects of the tuberculosis problem. In 1909 Sir Arthur Newsholme wrote an important memorandum on *Administrative Measures in Tuberculosis*, in which much of the future tuberculosis organisation was foreshadowed. Scotland had regarded pulmonary tuberculosis as a notifiable infectious disease in 1897 (Public Health (Scotland) Act). In England and Wales, in a few towns prior to 1908, all cases of pulmonary tuberculosis were notifiable under local Acts of Parliament, while, in an appreciable number of urban and rural districts, voluntary notification of cases of pulmonary tuberculosis was invited by the sanitary authority, and secured in some proportion of the total cases of this disease.

In 1907 special encouragement was given by the Local Government Board to the voluntary notification of cases of pulmonary tuberculosis; in 1908 the Board issued the Public Health (Tuberculosis in Hospitals) Regulations making notification compulsory for cases of pulmonary tuberculosis, coming under the care of Poor Law medical officers, either at home or in Poor-Law institutions; these regulations were followed by the Public Health (Tuberculosis in Hospitals) Regulations, 1911, providing for the compulsory notification of

PLATE XII.



FIG. 2.—SIR JOHN BURDON-SANDERSON (1828-1905)



FIG. 3.—SIR ARTHUR NEWSHOLME (1857-1943)



FIG. 1.—  
GEORGE  
BODINGTON

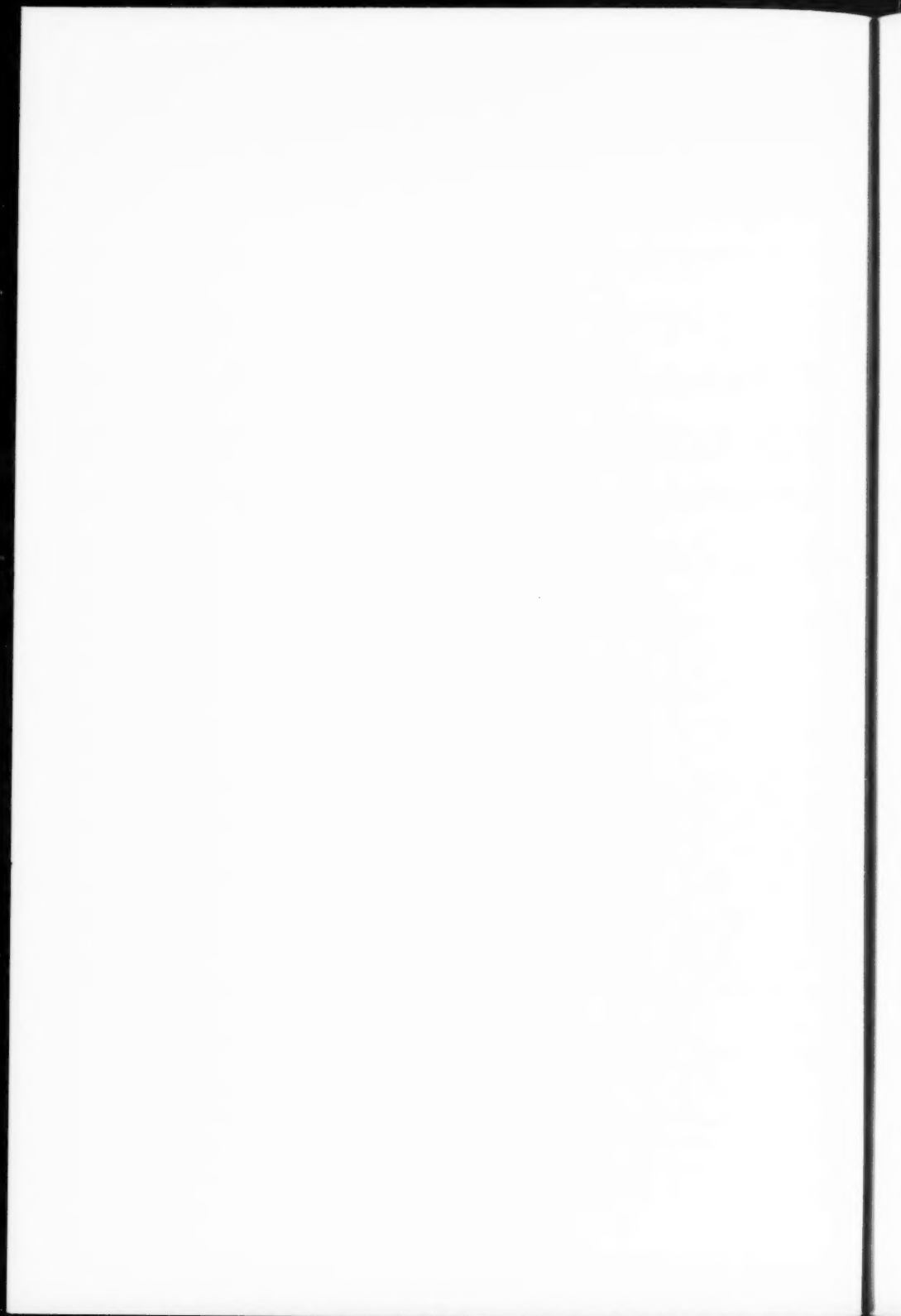
(1799-  
1882)



FIG. 4.—SIR ROBERT PHILIP (1858-1939)



FIG. 5.—SIR PENDRILL VARRIER-JONES (1883-1941)



all cases receiving treatment in public institutions; the Public Health Regulations (Tuberculosis), 1911, made the notification of all cases of pulmonary tuberculosis compulsory. Finally, in 1912 the Board's order extending compulsory notification to cases of all forms of tuberculosis and consolidating the three previous Orders came into force. The medical officer of health was made responsible for the action needed to trace sources of infection, or to remove conditions favourable to infection.

#### THE TUBERCULOSIS SERVICE

The resources for attacking the problem of tuberculosis were strongly reinforced by the National Insurance Act, 1911. This Act dealt, as regards tuberculosis in insured persons, with (a) treatment, (b) erection of sanatoria and other institutions, (c) research, and (d) education. It was open to the obvious criticism that only insured persons in the community received specialised treatment for tuberculosis, and that the measure was not one of general public health. The Government met this criticism by appointing a Departmental Committee under the chairmanship of Lord Astor, in 1912, to report upon the consideration of general policy in respect of the treatment of tuberculosis in the United Kingdom. The committee issued an interim report in 1912 and a final report in 1913. Two important findings were: (1) that any scheme which is to form a basis for the control of tuberculosis should be available for the whole community; and (2) that the organisation of schemes through the country can best be carried out if undertaken by local authorities.

The complete scheme for the prevention, detection and treatment of tuberculosis adopted by the Local Government Board was virtually that recommended by the Departmental Committee. It comprised: (1) the medical officer of health of a county council or county borough as chief administrative officer; (2) tuberculosis medical officers appointed by the local authorities; (3) dispensaries (including a system of health visiting); (4) sanatoria for early cases; (5) hospitals for intermediate and advanced cases. Insured persons suffering from tuberculosis might be placed upon domiciliary treatment (Section 16 (1) (b) of the National Health Insurance Act).

The Tuberculosis Schemes initiated the federal control of public health services. The Local Government Board acted as a sanctioning, advisory and subsidising body. For Wales tuberculosis work was done on similar lines by the Welsh National Memorial Commission. For Scotland supervision was exercised by the Scottish Board of Health (now the Department of Health for Scotland).

Much of the field had been surveyed by 1914. The chief difficulty lay in the provision of residential institutional accommodation, and it was soon evident that most local authorities must provide their own institutions. The war checked progress of the campaign. In 1915 an embargo was laid on the construction of new sanatoria, although the incidence and mortality of tuberculosis increased during the war. Towards the end of the war came an overwhelming demand for beds in sanatoria for ex-service men. Many local authorities took action, stimulated by a circular on the subject from the Local Government Board. In April 1918 the number of beds available in voluntary

institutions and in sanatoria and hospitals owned by local authorities was 12,441. By July 1, 1919, the number was increased to 14,014.

In that year the Ministry of Health was founded and a special branch dealing with tuberculosis was set up with a senior medical officer in charge.

This comprehensive service cannot have failed to exercise a most beneficial influence upon the decline of tuberculosis, "the Captain of the Men of Death," as John Bunyan termed it. In 1911, immediately prior to the setting up of the national scheme for combating tuberculosis, there were in England and Wales 38,422 deaths from tuberculosis of the respiratory system, a figure which in 1938 had declined to 21,930. The diminutions in the deaths from other forms of tuberculosis (bone and joint disease, meningitis, glandular disease) were even more remarkable. In England and Wales in 1911 these deaths were 14,698; in 1938 they had fallen to 4,426. The prevention of contact infection, the increased pasteurisation of milk, earlier ascertainment and skilled surgical treatment, all no doubt had their effect in this remarkable result.

#### THE GREAT MACHINE OF CONTROL

The land had peace for twenty years, and in that period much was done to extend, improve and develop anti-tuberculosis work. A great administrative machine for the prevention, control and treatment of tuberculosis was built up, based on the indisputable facts that anti-tuberculosis work is an integral part of public health, and every measure calculated to promote the health and well-being of the community contributes towards it. So the methods of attack must be comprehensive, various and co-ordinated. First there were the general measures of public health—*e.g.*, environmental hygiene, housing, abatement of overcrowding, pure milk supply and good nutrition. Then came the Maternity and Child Welfare and the School Medical Services. With these were co-ordinated the Tuberculosis Service itself. Valuable educational work has been rendered by the National Association for the Prevention of Tuberculosis and the Tuberculosis Association, and the Joint Tuberculosis Council aided progress in many directions. One can only briefly note certain important advances:

*The Surgical Treatment of Tuberculosis.*—"Artificial pneumothorax is the only advance in the treatment of pulmonary tuberculosis since the introduction of sanatorium treatment as carried out at Nordrach," wrote the late Sir James Kingston Fowler in 1921. Since that date great advances (thoracoplasty, pneumectomy, etc.) have been made in the surgical treatment of pulmonary tuberculosis. This has enabled successful treatment to be given to many intermediate and advanced cases, the arrest of whose disease was formerly regarded as either hopeless or problematical. It has also led to a more intelligent use of sanatorium and hospital treatment in relation to the individual patient.

*The Village Settlement.*—Papworth, founded by that great pioneer Sir Pendrill Varrier-Jones, provides treatment and social security for patients suffering from tuberculosis in nearly all stages of the disease. The maintenance of a tuberculous person and his wife and family in a village settlement is the most valuable piece of tuberculosis case-work that can be devised. With



Papworth is associated the village settlement at Enham, Hants. The Ministry of Health have from the beginning taken great interest in the establishment of such settlements. They made monetary grants to Papworth and to Preston Hall, a village settlement for ex-service men now controlled by the British Legion; they have also encouraged settlements at Barrowmore, Cheshire, and Sherwood Village Settlement established by the Nottinghamshire County Council in 1937.

*X-rays.*—The improvement in X-ray technique and the consequent important aid they afforded in the diagnosis of pulmonary tuberculosis and in the control of collapse therapy were features of this period. The value of tomography was established by the work of McDougall and Turning in this country. Lastly, came mass radiography, which has been developed so much during the last war and subsequently for the diagnosis of the early case of pulmonary tuberculosis.

*Research Work.*—There has been close association of research work in tuberculosis with practical application. Important work in this field was done by the Tuberculosis Committees of the Medical Research Council. Valuable work has also been done by the Prophit Trust of the Royal College of Physicians, Papworth Research Institute, the Tuberculosis Association and other research bodies.

*The Local Government Act.*—The Local Government Act of 1929 made it possible to treat all necessitous cases of tuberculosis under the Tuberculosis Schemes of local authorities.

The above were notable stages in progress. There were of course many other advances such as the continued improvement in the surgical treatment of non-pulmonary tuberculosis in which Sir Henry Gauvain's work at Alton proved so beneficial, the success achieved in the treatment of laryngeal tuberculosis, etc.

#### TUBERCULOSIS DURING THE WAR OF 1939-45

As has been stated, in the War of 1914-18 there was a general rise in mortality from tuberculosis in this country mainly due to contact infection, overcrowding and breaking down of bodily resistance through prolonged physical or mental strain. During the last war, in 1940 the deaths from respiratory tuberculosis in England and Wales were 23,660 and in 1941, 23,633. The figures of deaths for 1942, 1943, 1944 and 1945 showed a decline, being 20,989, 21,342, 20,104 and 20,013 respectively. The most disquieting feature was that deaths from pulmonary tuberculosis and tuberculous meningitis in children increased substantially during the war. The Ministry of Health not only helped to maintain the tuberculosis services, but gave special attention to the question of after-care. The Medical Research Council issued a useful report on tuberculosis in 1942. Miniature or indirect radiography has been generally adopted. The Minister of Health set up a Standing Advisory Committee on tuberculosis on which the Ministry of Health, the London County Council and the Society of Medical Officers of Health had representation. This was succeeded in 1949 by a new Standing Tuberculosis Advisory Committee of the Central Health Services Council.

## THE NATIONAL HEALTH SERVICE ACT

The National Health Service Act, which came into force in 1948, drastically altered the organisation of the Tuberculosis Schemes of local authorities. Institutions for tuberculosis, including dispensaries, hospitals and sanatoria, came under the Regional Hospital Boards, while the County and County Borough Medical Officer of Health was left with the preventive side of the work. It is obvious that the fullest possible co-ordination is required between the public health and the clinical side of anti-tuberculosis work, and every effort should be made to preserve that co-ordination which has worked so successfully in the past.

## Conclusion

Reviewing the whole subject of the control of pulmonary tuberculosis in England, there is much room for encouragement. The decline in mortality has continued. The deaths from respiratory tuberculosis in England and Wales in 1948 were 19,088. A similar decline has been noted in other countries with organised methods of attack. J. B. McDougall, head of the tuberculosis section of the World Health Organisation, notes that in New Zealand, Denmark, Holland and the United States, particularly, the figures have been reduced to such an extent that "if the present rate of decrease continues, the end of the present century may well find this disease as rare as leprosy is at the present time."

Mortality figures alone do not indicate the prevalence of tuberculosis in a country, but they are the best criterion we have. The rate may be influenced by a large prevalence in one or two areas, other large areas having extremely low rates. As W. Elliot has pointed out, a single region in Scotland containing less than one-third of the total population contributes over 50 per cent. of all the deaths from tuberculosis. Attack needs to be made on these foci of infection. There is still much to do in anti-tuberculosis work; the tuberculosis machinery of the National Health Service needs constant supervision, and the difficulty in recruiting nurses and domestic staff for sanatoria causes a lack of available beds for patients and long and regrettable waiting lists.

Recent work on chemotherapy, especially that relating to streptomycin, encourages the hope that eventually a drug will be found which will destroy the tubercle bacillus in man, and practical work is being done on immunisation with B.C.G.

The State Control of pulmonary tuberculosis has been justified by results. The high standard of clinical and preventive work set must be maintained to achieve further progress.

The illustrations which face p. 92 were kindly supplied by the Wellcome Historical Medical Museum. Their original sources were as follows:

Sir John Burdon Sanderson from Lady Burdon Sanderson, *Sir John Burdon Sanderson; A Memoir*, the Clarendon Press, Oxford, 1911.

Sir Arthur Newsholme, *Fifty Years in Public Health*, London, 1935.

Sir Robert Philip from *The Building of a Nations' Health*, by Sir George Newman.

Sir Pendrill Varrier-Jones from *The British Journal of Tuberculosis*, 1941.

## THE EVOLUTION OF THORACIC SURGERY

BY T. HOLMES SELLORS

From the London Chest, Middlesex and Harefield Hospitals

MILESTONES in the history of medicine sometimes fly past so rapidly that the speed prevents a proper appreciation of the landscape. This is particularly true with surgery, where the twin benefactions of anæsthesia and asepsis have in a few years transformed crude butchery into the science of surgery as we now know it.

The dictionary definition of the word "progress" as a "forward movement in space" is most applicable to modern surgery, where the exploring hand moves forward with tentative grasp. Sometimes an over-adventurous advance has to be followed by a wise retreat, so that the ideal is to be taken as cautious conservatism and to know when to hold the hand as well as to know when to decide on action.

Thoracic surgery has seen dramatic developments in the present generation. The surgical treatment of empyema was recognised by Hippocrates, but the problem of the open pneumothorax was not solved for practical purposes until after the first World War, 2,000 years later, and until then intra-thoracic surgery had always been a hazardous undertaking. The physiology of respiration had made considerable progress, but appreciation of more simple physio-mechanical problems of the thorax came more slowly, and only when the problem of anæsthesia had been partially solved could thoracic surgery be said to have made its real start.

To bring the position into perspective, it can be said that with the exception of occasional pioneer successes pulmonary resection as a standard procedure dates back only just over twenty years. Many of the more senior surgeons can recall the times when such operations were anxious in the extreme, both at the time and afterwards, whereas a modern lobectomy or pneumonectomy is now a routine undertaking with a mortality that compares favourably with any major surgical undertaking. Heart surgery is of even more recent development, and the last few years have seen routine treatment of such conditions as patent ductus arteriosus, pulmonary stenosis and coarctation of the aorta, while an attack on the heart valves, notably the pulmonary and mitral, has been initiated only in the last two or three years. Other forms of chest surgery have been practised successfully for longer periods; empyema drainage and thoracoplasty are examples in point, but in general we must look to the past ten or fifteen years rather than to twenty or thirty years for the period of decisive progress.

The factors contributing to the evolution of any speciality are varied, and many of them are closely allied to the general progress of medicine. It is doubtful if clinical observations and investigation have added much to diagnosis and assessment, for practical respiratory function tests are not yet dependable, but the association with radiology has become essential at all stages of diagnosis and treatment. Technical prowess is becoming (unfortunately in

some surgeons' views) of diminishing importance since anæsthesia and resuscitation measures have reduced the need for dexterity and speed. In chest work surgical craftsmanship cannot, however, be neglected, as occasional emergencies during operation demand all the foresight and quickness that experience alone can give. Possibly one of the most important features in carving out this branch of surgery has been the amount of work, enthusiasm and energy expended by the pioneers. Disappointments, lack of co-operation and even frank antagonism had to be overcome for many years before the diamond now well cut and reasonably polished, can be handed on to new entrants who, unless they are careful, may study only the facets and lose sight of the rough ground from which it originally came.

Radiology has already been mentioned as an integral part of thoracic work, but there is another speciality intimately bound up with the practical side of the work—anaesthesia. The stepping stones here were the introduction of gas oxygen and endotracheal tubes in the first place, and later intravenous agents in all their multiplicity. The problem was nearly always one posed by the surgeon, who at operation demanded the position most comfortable for himself—namely, the patient in the lateral position with the good or non-operation side undermost. Lack of appreciation of the mobility of the mediastinum, particularly when the upper hemithorax is open to the air, was possibly the greatest stumbling block, and many "syndromes" and mishaps attributed to "reflexes" or "vagal arrests of the heart" were simply the results of anoxia. "Controlled respiration" during anaesthesia solved many of the difficulties of the under-lung and gave the surgeon a relatively quiet operation field. Another principle to be early adopted was that of posturing the patient to avoid mediastinal displacement during operation and using the prone or face-down position. Intravenous anaesthetics and relaxing agents have given further advantages, making modern thoracic anaesthesia highly complex in detail though simple in principle, if the prime needs of free air passages and adequate oxygenation are satisfied.

Antibiotics have contributed many of their dramatic effects to chest surgery, both in the treatment and prevention of infections. Hæmolytic streptococcal infections were greatly feared before the introduction of sulpha drugs; pneumococcal pneumonia as a fertile source for empyemata has been largely eliminated, and more recently the course of tuberculosis has been influenced by streptomycin. As a prophylactic chemotherapy has been widely used and has been considered valuable in preventing the formation of post-resection bronchial fistula and empyema. There is, however, a salutary tendency to reserve antibiotics for actual or threatened infections and so avoid the development of resistant strains of organisms. Some special points have emerged about the use of antibiotics, notably penicillin, in chest work; these include the necessity for using unusually high dosage in pulmonary and cardiac infections and the importance of combining surgery with chemotherapy.

Physiotherapy has a special application in thoracic surgery, for it is only by the active effort of inspiration that full function can be regained. Special inspiratory breathing exercises have been devised in this country to develop localised and general lung expansion and to prevent postural deformities. These are of the utmost value in all forms of treatment, and the physiotherapist

rightly takes her place in the thoracic team—certainly not one of its least important members. Emphasis on this special technique is necessary, because many subscribe to its principles, but only a few have the knowledge and persistence to effect the results.

The tempo of chest work has been heavily influenced by the sanatorium from which so much of its work is derived. The general hospital was rarely a suitable place for thoracic surgery because of the long-term policy that was necessary for both tuberculous and non-tuberculous branches, and the work tended to grow up in special units and hospitals more or less out of touch with general hospital work. This has had considerable influence on the development of and attitude to this speciality. Formerly when lobectomies were of necessity routinely drained they occupied hospital beds for weeks and even months, but now with closed methods the convalescence of the average non-tuberculous chest patient is not in excess of the general ward surgical case. The advantage of a short-term stay is undisputed, but it brings in its wake several disturbing features, such as lack of attention to rehabilitation, and impatience with the slow tempo of tuberculosis treatment.

The thoracic team has evolved slowly round the surgeon and his collaborating physicians. In the early stages, as with any new work, only advanced or bad risk cases came to operation, with consequent disappointments, and it is fair to say that the attitude of some enlightened physicians did much to encourage progress. The anaesthetist was necessarily linked to the team, and in the course of his experience has acquired special skill in certain other techniques, notably bronchoscopy, which has extended his sphere well beyond the field of actual operation. The radiologist has always been associated with the team in its earliest stages, but where he combines clinical knowledge of chest diseases with his speciality he becomes invaluable. Pathologists with expert thoracic knowledge are not common, but individual specialists have had great influence on thoracic work as a whole and led the surgeon to temper enthusiasm with a modicum of discretion. Physiotherapists have already been mentioned, and occupational therapists are increasingly gaining recognition where a long-term stay is indicated. The assistants of a team were originally of the house-surgeon class, but as the work became more exacting and complicated a more highly qualified hierarchy has grown up. House officers are often experienced young surgeons with higher qualifications, while registrars and chief assistants are mostly well-trained general surgeons.

To turn to the surgeon again, he has had to acquire considerable "medical" knowledge and is one of the sectional jacks-of-all trades who must know something about every branch of his subject. Chest medicine, cardiology, endoscopy and radiological appearances are subjects he must be well acquainted with, and in this country the position could not be countenanced where a chest surgeon had to call in a specialist bronchoscopist on any occasion that the instrument had to be passed.

The scope of chest surgery is not always fully appreciated by the medical world, and without adequate contacts many patients are deprived of its services. Contacts are easy enough if the surgeon is on the staff of a hospital, and nearly twenty years ago some municipal authorities, notably the London County Council, established a panel of recognised surgeons who could visit



their hospitals. During the last war the Emergency Medical Service had a series of surgeons who were available and "on call" in their regions. The contacts established did much to improve the education, and the special units originally designed for casualty work became active chest centres. The significance of this development, when in the London area over 400 surgical chest beds were suddenly added and filled, is often overlooked. The infant thoracic surgery had become adult overnight.

There is the criticism that there is a loss of time if the chest surgeon becomes too mobile and spends hours and miles in travelling, but it has proved one of the most useful methods of exchanging knowledge; not only are patients seen, but information can be received as well as imparted. In many ways it is the continued and varied contacts that have to date prevented chest surgery from becoming as isolated as some other specialities. Admittedly there is splendour and efficiency in isolation, but the drawbacks are only too obvious.

What is the relationship of the recognised specialities, such as chest surgery, to general surgery? They have graduated out of general surgery, but have become separated for a variety of reasons. In the case of chest work the special hybrid "operating physician" approach, the circumstances of tuberculosis and the original long stay treatment contributed to separation rather than divorce. Also, it was more satisfactory to deal with patients in chest hospitals where the facilities were highly geared for the subject. Chest surgery has become associated with plastic and neuro-surgery as one of the high-grade or "super" (save the word) specialities, but there are certain differences which make the separation from general surgery of less marked degree. Chest surgery deals with nearly all systems within a set topographical field; bone, visceral, vascular and nerve tissues are all within its scope; in fact, it has been referred to on more than one occasion as one of the remaining citadels of true general surgery. The time may not be far distant when "chests" become an integral part of general surgery as it is now understood, rather than an isolated section.

The National Health Service with its opportunities for expansion has been actively interested in chest surgery, particularly where it concerns tuberculosis, and has shown that interest by making numerous new appointments to sanatoria and similar institutions. Theoretically the policy may be sound, but it fails by bringing the youngest (and least experienced) consultant to grips with the problem that former generations have regarded as the most difficult—namely, selection of the suitable patient for surgery. Moreover, it carries the risk of isolation and the formation of the one- or two-operation surgeon. Similar problems are developing with the former tuberculosis dispensaries, now chest clinics, who increasingly demand the support of the chest surgeon in their work.

#### EVOLUTION OF BRANCHES OF CHEST DISEASES

*Tuberculosis* affords by far the greatest proportion of patients for thoracic surgery. Ever since the introduction of artificial pneumothorax treatment there has been a steadily increasing demand for collapse therapy. Thoracoscopy, originally regarded as an occasional operation, has become necessary in a high proportion of all pneumothoraces that are suitable for maintenance, and



is the most frequently performed operation in chest surgery. Phrenicectomy has had a chequered career with periods of enthusiasm succeeding disinterest, though the introduction of pneumoperitoneum has increased its scope as a holding measure for use in domiciliary and similar treatment. In general, surgeons regard this operation less favourably than many physicians. Extrapleural operations have similarly suffered the ups and downs of fashion—a short vogue after the first World War in which paraffin wax “plombes” were used was followed by a prolonged interval before extrapleural pneumothorax gained popularity, but this also waned as the modern selective thoracoplasty developed. Again, after an interval of roughly seven or eight years the operation appeared in a modified form using plastic material as the “plombe” or filling material. The attraction of a one-stage operation followed by no deformity is considerable, but the fate of the dead space and its packing has yet to be determined.

Thoracoplasty started as an operation for use in chronic disease with cavitation where pneumothorax had failed. The original procedure involved a total collapse of one side, and partial operations were regarded with suspicion because of the alleged risk of atelectasis at the base. The modern partial operation developed about fifteen years ago, and became associated with apicolysis to make the collapse concentric rather than only lateral. It is rare now for a total thoracoplasty to be used except in empyema, and even there the tendency is to seek other methods. Apical thoracoplasty is the operation that has steadily stood the test of time, and indeed has gained in popularity as the low morbidity of the operation and its good end-results became realised.

To turn to other principles than collapse therapy, drainage of cavities has been tentatively tried out from the days when the Seton—a stout curved needle with threads which acted as a wick was passed through the skin and through the cavity—was employed to a more precise drainage by suction tube or open cavernostomy. In this country cavity drainage has had but little vogue, though the results when combined with chemotherapy have been promising.

Excision of diseased lung has never been far from surgeons' minds, but the whole picture has been dominated by the principle of keeping tuberculous disease “closed” and avoiding any incision into it. Moreover, the knowledge that tuberculosis is a general disease with local manifestations is a salutary indication that excision is not by itself a cure. The development of excision as a method of therapy was seriously handicapped by the unhappy results that obtained in the early days of lobectomy for bronchiectasis, where a tuberculous spread followed fistula formation and pleural infection in an unpleasantly high proportion of cases. However, the evolution of dissection technique, closure of the bronchus and pleural cavity, reduced this danger considerably until deliberate excision for tuberculous lesions was safely undertaken. Antibiotics, notably streptomycin, have made these operations safer (they do not affect the already minimal risk of thoracoplasty), but the early cases were operated on without this cover and nevertheless gave favourable results. In the United States excision dominates the picture in comparison with thoracoplasty, and indeed in this country has gained popularity; but later analysis may well find it hard for excision to improve on the results of permanent collapse, and many of the specious arguments pointing to the advantages of excising a

damaged area overlook the general nature of the disease. There are certain types of lesion which do, however, respond well to excision, and this has added a valuable weapon to our armoury of defence.

Possibly one of the most promising features in the treatment of tuberculosis is the insistence by the surgeon on full and adequate sanatorium treatment before and after surgery and the conservative attitude adopted in most cases. "Crash" and emergency treatments are rarely indicated, and surgery with its unhappy experience of complications arising from early and unnecessary treatment tries to restrain the present popular demand for "active therapy-at-all-costs."

Antibiotics have altered the approach to many forms of tuberculosis and indeed may cause us to abandon some of the established beliefs, but, so far, an experience of several years suggests that many more cases may be rendered suitable for surgery, some operations will be safe and just a few patients will avoid surgery. It would seem that surgery, allowing for expansion in undeveloped geographical areas, may increase, but that the extent of operation will become more limited and definitive rather than temporary.

It is strange that after years of study no fixed views are held about certain fundamentals of tuberculosis. For example, the route of infection in the adult type of disease by endogenous or exogenous methods is still undetermined and the mechanism by which cavities are closed is actively disputed—indeed, the nature of cavity formation is imperfectly understood.

*Lung excision*, which is chiefly used in carcinoma and bronchiectasis, originated in a piecemeal fashion where ligatures or cautery were used to destroy the exposed lung. These methods gave rise to a single-stage ablation, a snare or tourniquet being used to secure the blood vessels and bronchi at the hilum. After removal of most of the lobe or lung the stump was secured by mass ligatures before the tourniquet was released. The pleural cavity was routinely drained by a closed water-seal system, since a slough of the stump could be expected about the tenth or fourteenth day. The residual lung slowly expanded and the fistula closed when the pleural space was obliterated. A prolonged convalescence was necessary as a result of the drainage. The change-over to the modern form of dissection operation took place eleven to twelve years ago. In this all the hilar elements are exposed and separately secured, and the pleural cavity closed without permanent drainage (though a temporary drainage for twenty-four to forty-eight hours may be used). This operation is much more precise and complete than its predecessor and from it the segmental form of resection has developed, facilitating a more conservative approach in certain cases.

After lobectomy for bronchiectasis the problem of atelectasis of the residual lobe or lobes remains. Collapse can be anticipated and partly prevented by physiotherapy and relieved by posture or bronchoscopy, but nevertheless it constitutes a real danger to the end-result. Associated with this problem is the question of operation in a free or in an adherent pleural cavity. The pros and cons were disputed for some years, and artificial formation of adhesions was carried out (pleuropexy or "poudrage") in many cases until it was found unnecessary. Bronchial fistula is the one problem that has really remained unsolved, to judge by the diversity of methods

and techniques advocated to secure the permanent closure of the bronchus. When it occurs the probability of pleural infection is considerable, and indeed in the tourniquet or mass ligature days a fistula was expected. The real reduction in incidence came about the time penicillin was introduced, and the elimination of infection and better technique can probably claim equal share. The technical advance was the realisation that amputation of the bronchus flush with the next branch prevented formation of a stump which might become stagnant and infected.

The operation for carcinoma of the lung has not undergone any remarkable changes since its inception. Pneumonectomy is the ideal, so planned as to include the glandular field, and modifications such as excision of an area of pericardium and complete removal of the mediastinal pleura have been carried out. Lobectomy for growth, though not a radical operation, has some place in treatment, particularly in the case of elderly men with an early growth and a limited respiratory function. Radiotherapy has proved most disappointing in obtaining good end-results, though a certain amount of palliation of symptoms may be achieved. One factor seems to be standing out with increasing clarity, and that is that cancer of the lung is increasing in frequency and that heavy cigarette smoking over a period of years is a predisposing factor.

*Lung abscess* is one of the few conditions that has fortunately passed almost completely out of the hands of the chest surgeon. The classic foetid or putrid lung abscess was greatly feared, and if it failed to resolve drainage had to be used. The course of any operation case was hazardous, with pneumonitis, cerebral abscess and hæmorrhage giving a mortality of anything up to 30 to 40 per cent. Penicillin originally seemed to have little effect on the course of the lung abscesses, but when high doses were employed the picture altered and spontaneous resolution occurred. The process may take several weeks, but drainage is now never necessary, and the only place for surgery is excision of a localised bronchiectatic or a persistent cystic space (the healed or epithelialised cavity).

The treatment of *pleural suppuration* has undergone many changes of fashion, the pendulum swinging between early and late drainage, but in nearly every period there has been improper handling of the acute stage, with the result that disabling chronic empyemata have been allowed to develop. Treatment and prevention of chronic empyema alone would have justified the formation of thoracic surgery as a speciality. Acute pleural infection slipped between the hands of the physician and surgeon (the drainage of empyema was once a house physician's operation) and lay neglected in its most important stages. Discussions as to early or delayed drainage filled the picture, while the simple surgical principle of adequate and continued drainage at the most dependent point was ignored. The earlier efforts of thoracic surgery were to ensure that not only was an empyema drained at the right time, but that it would be controlled until final healing, and that a tube should not be removed from an empyema cavity but only from a track in the chest wall. Physiotherapy grew up to full stature in this field, and gradually excluded the complicated operations for closure of chronic empyemata by obtaining a final re-expansion of lung, even though a period of months was involved.

Since the free use of antibiotics pleural infection has become much less common. Lobar pneumonia has practically disappeared and many potential

empyemata are aborted, but once pleural infection has developed certain new problems arise. Chemotherapy can sterilise the majority of effusions, but this does not mean that the empyema is cured unless the fluid is completely removed by aspiration. The aspirating needle and syringe are in general sadly misused, and a common result is a persistent localised and thick-walled sterile abscess cavity. Only one principle of empyema treatment has been satisfied—namely, sterilisation or removal of the toxic element—but closure of the cavity has not been achieved. As a result of this the operation of decortication, pleurectomy or “empyema” resection has been revived to deal with this new problem.

*Hemothorax* is a common finding in war injuries, and the dangers of its infection were fully realised in the first World War. The fact that blood in the pleural cavity remained fluid was appreciated as permitting aspiration, though the mechanism of this apparent failure to clot was obscure. More recently this process has been shown to be one of defibrination with a reactionary fibrinous exudate leading in untreated cases to a secondary fibrin clot. This has been erroneously referred to as clotted hemothorax, which implies clot formation of the original blood, whereas it is really a clotting of a blood-stained fibrinous exudate. The experience of the last War made the issue of hemothorax treatment clear-cut and satisfactory—early and complete removal of the fluid without the admission of air.

The fascinating development of *cardiac surgery* in the past two or three years is the culmination of collected clinical experience and experimental work. Pericardiectomy showed that the heart could be safely handled, traumatic surgery has proved that incision and suture were not incompatible with life; experimental work demonstrated that anastomosis could be made safely between the great vessels. With this background the ligature of patent ductus arteriosus became the first active step, to be followed by resection of coarctation of the aorta with end-to-end suture and pulmonary-systemic arterial anastomosis for the relief of pulmonary stenosis. Only a year or two has elapsed since pulmonary and mitral valvulotomy have become accepted methods of treatment in selected cases. We are too close to the expanding field of heart surgery to say when its limits will be reached, particularly as methods for short-circuiting the heart and passing the blood through an artificial heart-lung machine are well advanced experimentally.

No speciality has grown up along an easy way, and thoracic surgery has had a hard furrow to plough before its growth could be assured. The early and few pioneers have been reinforced by a large number of enthusiastic pupils who routinely carry out operations which were regarded as almost impracticable twenty years ago. An experimental and dangerous field has become a safe and well-recognised branch of medicine, and it would be a bold prophet who would prescribe the limitations of chest surgery in the future.

## SIDEROSIS

By A. I. G. McLAUGHLIN

From the Factory Department, Ministry of Labour and National Service

SIDEROSIS is still defined in many textbooks as a fibrosis of the lungs caused by the inhalation of the dust of iron and other metals. This is not surprising, because it is the oldest of the pneumoconioses, the term having been introduced by the German pathologist Zenker in 1866, when at the same time he coined the word "pneumonokoniosis," later shortened to pneumoconiosis. The term "silicosis" was first used in 1871 by Visconti. Presumably the word "siderosis" comes from the Latin *sidus*, *sideris*, a star, and from the fact that falling stars or meteorites are largely composed of iron. Zenker described two cases of siderosis, the first being a woman who had been employed for seven years in the preparation of blotting paper by a now obsolete method of rubbing in powdered dry iron oxide, which the Germans called "English red"; and the second a man who had worked for twenty-five years at polishing mirrors with a similar powder. Both these cases had tuberculous fibrosis as well as iron pigmentation of the lungs, a fact which probably led Zenker to the conclusion that iron oxide could cause fibrosis of the lungs. Single cases of siderosis were also described by Merkel (1869) and by Langguth (1895). The latter's patient had been a miner of red ironstone for forty-one years. Of these four cases recorded between 1866 and 1895, three had pulmonary tuberculosis and the fourth probably had it; Langguth's case probably had silicosis as well. It is easy to understand, therefore, that fibrosis was a feature of all four cases, though Merkel's case showed only minimal amounts.

Hart, in 1910, described two varieties of siderosis, the red type which arises from the inhalation of iron ore dust and iron oxide, and the black type which is said to occur in grinders or polishers of metals. It is likely that the latter type was not a true siderosis, because grinders at that time were using sandstone wheels and inhaled a mixed dust containing free silica as well as iron and its oxides. Up to 1930, when Bohrod summarised the literature, only thirty cases of siderosis had been described. He added two more cases to the list, one being a hæmatite miner and the other a grinder of metals. Neither case was an example of pure siderosis.

## HÆMATITE MINERS

Four years later Stewart and Faulds (1934) published their classical paper on the hæmatite miners and showed that these workers developed a sidero-silicosis. They found the histological lesion to be a characteristic one, mainly on account of the hæmatite dust ( $\text{Fe}_2\text{O}_3$ ) present in the lungs, the fibrosis being diffuse rather than nodular and often associated (in eleven out of fifteen autopsies) with tuberculosis. The lesion in hæmatite miners does not really help to decide whether iron or iron oxide can cause fibrosis of the lungs, because the miners are exposed to a mixed dust. In some mines the dust contains less



free silica than in others, and in some autopsies there was evidence of the presence of pigmentation without fibrosis (Craw, 1938). Experimental work by Carleton (1927), by Haynes (1931) and by Naeslund (1938 and 1940) had shown that inhaled hæmatite dust without silica did not produce fibrosis of the lungs of guinea-pigs or rabbits. The first hint that some of the marked X-ray shadows (see Fig. 1) in hæmatite miners might be thrown by a dust opaque to X-rays was given by Collis in 1923, when he said that "X-ray photography, it is true, has disclosed the presence of shadows suggestive of fibrosis in the lungs of these hæmatite miners, but the opacity of oxide of iron to X-rays rather detracts from the significance of these findings." He adds, "nevertheless the suggestion does emerge that possibly the dust of iron oxide may exert in a modified way a similar influence to that of silica."

#### ELECTRIC ARC WELDERS

Intensive studies of the effects of iron dust on the lungs followed the paper by Doig and McLaughlin (1936) in which they showed that electric arc welders develop generalised reticular and nodular shadows in X-ray films of the chest (Fig. 2). The fume arising from welding consists mainly of iron oxide in fine particle size. Doig and McLaughlin emphasised that their group of sixteen welders showed no disability, and they suggested that, amongst other possibilities, the iron oxide particles might be opaque to X-rays and produce the abnormal X-ray picture without the presence of pulmonary fibrosis or congestion. They were unable to obtain post-mortem material to confirm this or their other suggestions. But Enzer and Sander (1938) obtained post-mortem evidence in one welder, who during life had shown the characteristic X-ray appearances, and who died as the result of an accident. No evidence of fibrosis was found in the lungs either on naked-eye examination or in histological sections, despite the presence of much pigmentation in the peri-arterial and peribronchial lymph spaces. This is still, after thirteen years, the only published account of an autopsy on an arc welder with an uncomplicated occupational history.

The original observation about the presence of abnormal shadows in chest films of electric arc welders has been amply confirmed by many investigators [*e.g.*, Britton and Walsh (1940), Koelsch (1941), Grämer (1942), Humperdinck (1942), Groh (1944) and Jones and Lockhart (1944)]. Clinical and statistical studies [Enzer and Sander (1938), Sander (1947), Enzer *et al.* (1945), Doig (1949, 1950)] revealed no signs of fibrosis or diminished pulmonary ventilation, though Killick (1938) had reported physical disabilities in five arc welders with fine mottling in the X-ray films not found in six other welders with no visible mottling.

Similar shadows have also been found in the chest X-ray films of carbon arc and oxyacetylene welders who present no physical disabilities (Doig and McLaughlin, 1948). The fume arising from these operations also consists mainly of iron oxide particles.

#### SILVER FINISHERS

The next group of workers to be studied were silver finishers or polishers, who use fine iron oxide powder of a high degree of purity (rouge or crocus) to



polish silver articles. Polishing is done either by hand or more usually by pressing the article against a revolving wheel or dolly to which a mixture of rouge and water is applied. Polishing by hand is not a dusty process, but a good deal of dust is thrown from the dollies even when they are under exhaust ventilation. These workers, therefore, inhale throughout their working life a good deal of iron oxide dust. But they also breathe in particles of silver, a fact which leads to an interesting histological appearance. McLaughlin, Grout, Barrie and Harding (1945) described the X-ray appearances in four silver finishers as a generalised fine stippling or reticulation (Fig. 3). All four men were in good health, but one of them died seven years later as a result of an operation for gastric ulcer. On histological examination of the lungs three kinds of pigment were found. The first was iron oxide particles enclosed in and filling phagocytic cells, most of which were found in collections or aggregates under the pleura and alongside the pulmonary vessels (Fig. 4). The pigment in these situations did not give a positive Prussian blue reaction for iron, but it remained after incineration of the sections as a reddish-brown substance when viewed in reflected light. The second type was a finely granular pigmentation of the elastic laminae of the pulmonary arteries and of the elastic laminae in the alveolar walls (Fig. 5). After incineration the lines of pigment appeared as shining white lines. But when the sections were treated with potassium cyanide the pigmentation disappeared (Fig. 6). It is fairly certain that this type of pigmentation was caused in inhaled silver particles, and in fact constituted an *intra vitam* staining of the elastic tissue. The third type of pigment was present in intra-alveolar phagocytes which gave a positive reaction to the Prussian blue test for iron. No fibrosis was found in relation to the intrapulmonary deposits of iron-containing phagocytes. Three confirmatory necropsies were later described by Barrie and Harding (1947). In a fifth case described by Harding (1948) slight fibrosis of the "reticulation" type was found, but the occupational history showed that the man had worked for five years as a labourer in a steel works and the rest of his working life as a silver finisher. In the other cases there was no complicating factor in the occupational histories.

As regards experimental evidence, Harding (1945) and Harding, Grout and Lloyd Davies (1947) introduced iron oxide (rouge) into the lungs of rats both by intratracheal injection and by inhalation, and obtained radiographs comparable with those obtained in human siderosis. Histological studies showed that fibrosis did not develop in relation to the deposits of iron oxide in the lungs. It had previously been shown [McLaughlin *et al.* (1945)] by experiments with sponges that iron oxide is opaque to X-rays.

#### OTHER WORKERS WHO INHALE IRON

Other evidence confirming the inert nature of iron and iron oxide dust in the lungs has been obtained by the examination of workers exposed to the inhalation of iron and iron oxide dust in other industries. For instance, the makers of electrolytic iron oxide, the purest form of the material, develop abnormal X-ray shadows after about ten years' exposure, comparable with those of welders and silver finishers, and show no clinical evidence of ill-health.

Of fourteen men whom Davidson examined in 1938, six who had been engaged on the work for more than ten years presented the characteristic X-ray picture (Fig. 7). Otto (1939) mentions a case of siderosis in a man employed in an ochre mine and mill; he presented few symptoms. Vigliani (1944) examined eighty-one workers exposed to the inhalation of iron rust and scale in iron and steel rolling mills, and found that thirty-seven of them presented X-ray signs of siderosis without clinical symptoms of disability. In twenty-two cases there were slight abnormal X-ray changes (early reticulation), eleven moderate (marked reticulation) and four cases with advanced changes (nodulation). The average age of these workers was forty-six years and the average length of exposure twenty-five years. Buckell *et al.* (1946) found seventeen out of 171 persons exposed to iron dust in iron turneries showing radiographic reticulation, but symptoms were few. Pendergrass and Leopold (1945) record four cases of what they call benign pneumoconiosis amongst fifty steel grinders; Sander (1947) describes three cases in oxyacetylene cutters, and Hamlin (1947) four cases in foundry grinders and burners. In all three series the men worked in rooms where there was exposure to silica dust as well as to iron, but the amount of silica dust was considered too low to cause silicosis. Hamlin and Weber, (1950) supported by animal experiments carried out by Vorwald *et al.* (1950), develop this thesis in later papers. Clinical and X-ray observations were made in a series of sixty-nine foundry grinders and burners exposed for varying periods (one to sixteen years) to high concentrations of iron oxide dust and what is regarded as "insignificant" amounts (1.5-16.3 per cent. of all particles below  $5\mu$ ) of free silica. Nodular shadows were discovered in the radiographs, and in some cases coalescent shadows suggesting the presence of pulmonary tuberculosis were also seen. These shadows remained static over a period of sixteen years and in some cases the coalescent shadows tended to clear. Hamlin and Weber regard the nodular shadows as being caused only by deposits of iron and iron oxide, because clinically the men showed no symptoms which might be attributed to occupational disease, and also because the concentration of free silica dust was well below the "maximum allowable concentration" of 5 million particles per cubic foot. It is clear that the condition they describe runs a benign course, but in the absence of human pathological studies it is difficult to accept their conclusion that no fibrosis is present in the lungs of these workers. Admittedly, the animal experiments by Vorwald *et al.* constitute strong supporting evidence, by showing that after three years no fibrosis developed in the lungs of guinea-pigs, rats and rabbits. It may well be that three years is not long enough to produce fibrosis in such animals with dusts containing about 4 per cent. free silica. It will be recalled that iron oxide was the first dust shown by animal experiments to have a restraining influence on the fibrogenic properties of free silica [Kettle (1932)]. Pathological studies of the lungs of iron and steel foundry cleaning room workers have shown that the usual length of exposure before death from silicosis and mixed dust pneumoconiosis with or without tuberculosis is twenty-five to thirty years, much longer than is the case in sand and shotblasters, though X-ray evidence of pulmonary involvement may be found after ten years' exposure [Harding, Gloyne and McLaughlin (1950)]. The "maximum allowable concentrations" of silica and other dusts are put forward on somewhat scanty evidence, and no allow-

Fig. 6. Iron  
oxide  
nodules  
deposited  
in the  
lymph  
nodes  
of a  
foundry  
worker.

Fig. 7. Ph  
log of sil  
piment-  
mentation

Fig. 7. -  
maker -  
showing  
micro  
points of  
implantation

# PLATE XIII.



FIG. 1.—Radiograph of chest of hematite miner showing fine generalised mottling or micro-nodulation due to deposits of radio-opaque hematite dust in the peribronchial and periarterial lymph spaces. This man died from a gastric complaint and no silicosis was found at autopsy.

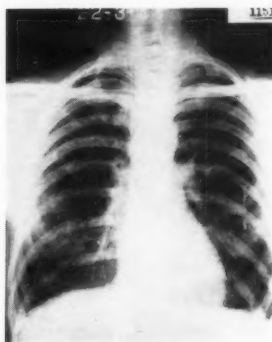


FIG. 2.—Radiograph of lungs of an electric arc welder who had worked at this job for twenty-three years. The film shows fine generalised nodulation more marked in the lower zones. This man, who is 47 years of age, has no disability or symptoms of ill-health.



FIG. 3.—Radiograph of lungs of a silver finisher showing fine generalised stippling, more marked in mid-zones. The shadows are due to deposits of iron oxide in the lymphatics of the lung. For histological appearances see Figs. 4, 5 and 6.

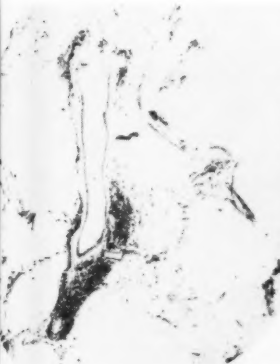


FIG. 4.—Photomicrograph of unstained section of lung of silver finisher (X17) showing aggregate of pigment-containing cells and fine linear pigmentation of wall of vessel.

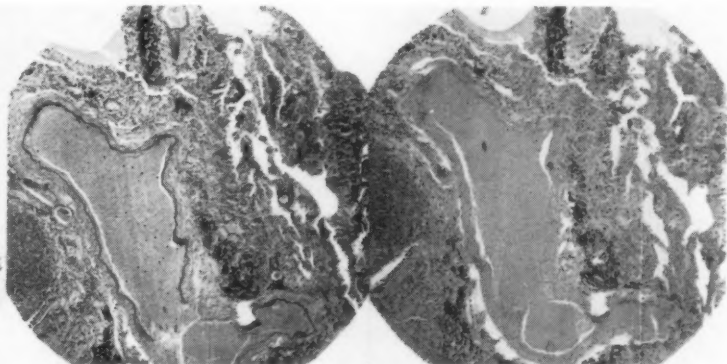


FIG. 5.—Photomicrograph of section of lung of silver finisher (X36), stained with haematoxylin and eosin, showing fine linear pigmentation of wall of vessel with aggregates of pigment-containing cells in the perivascular lymphatics.

FIG. 6.—Duplicate section of Fig. 5 treated with KCN before staining. Note loss of pigment in artery wall and alveolar walls.

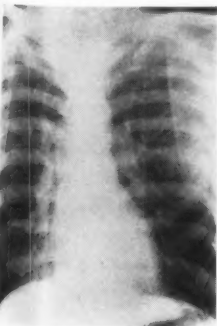


FIG. 7.—Radiograph of lungs of maker of electrolytic iron oxide showing fine generalised stippling or micro-nodulation due to deposits of iron oxide dust in the lymphatics of the lung.

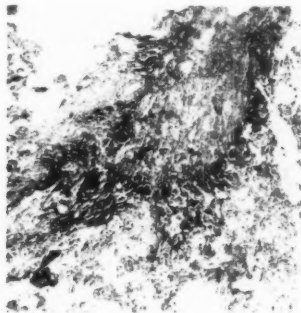


FIG. 8.—Photomicrograph of lung of carbon arc welder who had worked in a steel fettling shop. Typical silico-siderosis. (X6.)

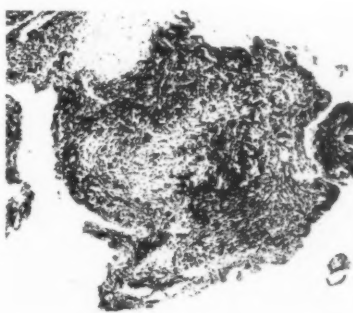


FIG. 9.—Photomicrograph showing nodule of mixed dust fibrosis in a foundry worker's lung. (X28.)

# PLATE XIV.

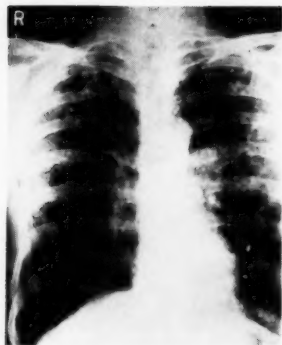


FIG. 10.—Radiograph of boiler scaler's lungs showing nodulation in outer and upper lateral zones and reticulation over rest of lung fields.

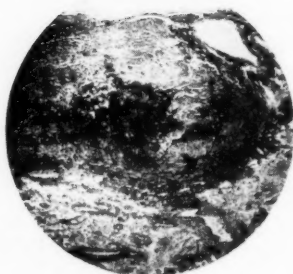


FIG. 11.—Photomicrograph showing subpleural silicotic nodulation in a boiler scaler's lung, R. upper lobe. H. & E.  $\times 4$ .

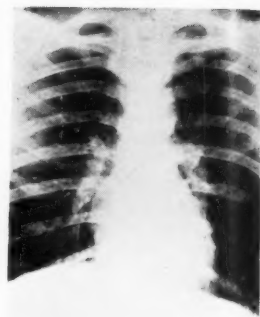


FIG. 12.—Radiograph showing sileriosis in an electric arc welder's lungs. Reticulation with tendency to nodular formation.

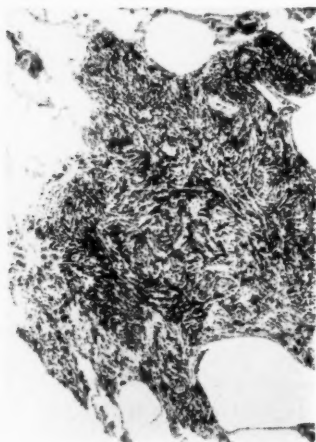


FIG. 13.—Photomicrograph showing nodule of mixed dust fibrosis in boiler scaler's lung, R. middle lobe. H. & E.  $\times 46$ .

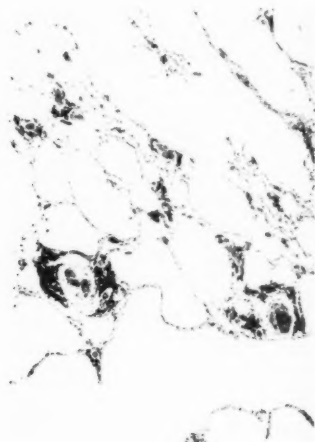


FIG. 14.—Photomicrograph of boiler scaler's lung, R. lower lobe. H. & E.  $\times 26$ . Showing pigmentation without fibrosis around vessels.



FIG. 15.—Radiograph of same case as Fig. 12 but eleven years later showing complete clearing of shadows.

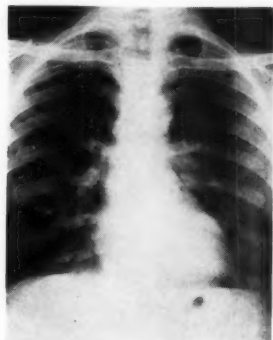


FIG. 16.—Radiograph showing "snowstorm" silicosis in a sandblaster.

ance is made for individual susceptibility and personal factors in the development of pulmonary fibrosis. In any event, the cases described by Hamlin and Weber are not instances of pure siderosis, because they have been inhaling a mixed dust and are probably more akin to the hæmatite miners than to the welders.

By contrast, Harding, Gloyne and McLaughlin (1950) describe in detail the pathological findings in a carbon arc welder of fifty-five years of age who had worked for about thirty-four years in a steel fettling shop. He had been exposed to the inhalation of high concentrations of iron oxide from the welding fume together with smaller quantities of free silica in the general atmosphere of the shop. Death was due to subacute nephritis with cardiac failure and intercurrent bronchitis and bronchopneumonia. Typical silicotic nodules were present in a lymph gland, and throughout the lungs were large areas of fibrosis with a suggestion of whorling, but they were not typically silicotic (Fig. 8). The lesions were similar to those found in boiler scalers [Harding, Tod and McLaughlin (1944)] who inhale dust containing large percentages of iron and small percentages of free silica. Again, they resemble the histological lesions found in graphite workers [Harding and Oliver (1949), Gloyne, Marshall and Hoyle (1949)] in which the graphite contains fairly low percentages of free silica. The lesion also resembles that found in some coal miners. The common denominator in all these groups is that the workers are exposed to the inhalation of a mixed dust containing low percentages of free silica, and the histological lesion in each group has a radial and linear pattern rather than a whorled one (see Fig. 9). Harding, Gloyne and McLaughlin (1950) suggest that this is a modified silicosis and that the term "mixed dust pneumoconiosis" or "mixed dust fibrosis" might be applied to it.

#### BOILER SCALERS

Against the theory that small percentages of free silica (of the order of 4-5 per cent.) in a mixed dust are "insignificant" the experience of boiler scalers may be cited. These workers clean the flues and fire boxes of boilers and are exposed to high concentrations of a dust which contains amongst other things silica (free and combined), carbonates, iron and carbon. It is a very variable dust, because it depends on the hardness of the water used in the boilers and on the type of fuel used—*e.g.*, coal or oil. Two important constituents of both flue dust and boiler scale are silica and iron, and in the case of marine boilers of fishing trawlers working from Hull, the boiler scale usually contains about 8-10 per cent. total silica and 10 per cent. of iron. Flue dust contains about 6 per cent. total silica and 48-50 per cent. of iron. The free silica content is, of course, much less than the total silica content. In spite of a low  $\text{SiO}_2$  content, boiler scalers have been found to develop silicosis and mixed dust pneumoconiosis [Dunner and Hermon (1944), Harding, Tod and McLaughlin (1944 and 1947)]. It is probable that the total dose of free silica is more important than its percentage in a mixed dust. In one case which came to autopsy there were nodular shadows present in the X-ray film (Fig. 10) more marked in the upper zones, whereas in the lower zones there were stippled and reticular shadows. Histological studies of sections of the lungs suggested that



the nodular shadows corresponded to silicotic nodules (Fig. 11) and that many of the reticular shadows were thrown by iron aggregates without fibrotic reaction in the lung tissues (Fig. 14). Some of the reticular shadows were also due to early silicotic fibrosis or to modified silicosis (mixed dust pneumoconiosis) (Fig. 13). In another case no classical silicotic nodules were found, but there were nodules of mixed dust pneumoconiosis each surrounded by a zone of emphysema. The X-ray picture in this case was one of reticulonodulation. In the first case the iron content of the dried lung was 0.6 per cent. and the silica content was 0.17 per cent. In the second case iron made up 0.4 per cent. and silica 0.2 per cent. of the dried lung. These cases belong to the group designated sidero-silicosis, and are comparable with hæmatite miners and foundry workers.

#### HÆMOSIDEROSIS

Aggregates of iron pigment can be deposited in the lung tissues from the blood (endogenous) as well as being brought in with the inspired air (exogenous). It has been observed for some time that patients with long-standing mitral stenosis developed nodular shadows in their chest X-ray films. The condition was first mentioned by Virchow in 1858. There is also an obscure (or idiopathic) form of hæmosiderosis, as it is now called, not associated with heart disease. Apart from the large heart shadow seen in the first type, there is little to distinguish the X-ray picture from that seen in industrial siderosis. A good review of the subject has recently been published by Lendrum, Scott and Park (1950). These authors state that whenever a characteristic X-ray picture has been obtained during life, the lung has shown on microscopy multiple focal depositions of hæmosiderin. The aggregates of iron pigment enclosed in phagocytes or siderophores are situated in groups of adjacent alveoli and are caused by hæmorrhages in the walls of the terminal bronchioles, where the capillary anastomoses between the pulmonary and bronchial arteries are believed to lie. Iron escapes from the alveolar depots into the surrounding tissue and causes a fibrotic thickening of the alveolar walls. The fibrous capsule so formed obstructs the lymphatic drainage and prevents the clearing away of the iron deposits. There are therefore histological differences between hæmosiderosis and industrial siderosis, in that in the former the aggregates of iron pigment are intra-alveolar and in the latter are found mainly in the peribronchial and periarterial lymphatic channels and nodes. Inhaled inorganic iron does not produce a fibrotic reaction, whereas the organic iron causes a fibrosis which is sharply limited. In fact, the lung tissue between the aggregates of hæmosiderin is remarkably normal in appearance. In Ceelen's hæmosiderosis also, described first in 1931, which occurs in childhood and is characterised by repeated generalised intrapulmonary hæmorrhages, there is widespread fibrosis in relation to the local high concentrations of organic iron. This condition has been reviewed in detail by Wyllie, Sheldon, Bodian and Barlow (1948). Meiklejohn (1949) described an interesting case of a coal miner in which pneumoconiosis and hæmosiderosis secondary to mitral stenosis co-existed. A further difference (explained by the histological features mentioned above) between hæmosiderosis and industrial siderosis is that the X-ray



abnormalities in the former tend to be permanent, whereas in the latter the shadows may clear after a period of years if no more iron or iron oxide dust is inhaled. Further reference to this point is made below.

### Discussion

It is evident that Zenker's original conception of siderosis as being a fibrosis of the lung is no longer valid, because it has been shown conclusively that inorganic iron and iron oxide will not cause fibrosis, either collagenous or reticular. Little or no physical disability appears to be caused by the presence of iron oxide dust in the lungs, though it cannot be assumed that it is completely harmless. As Perry (1947) says, "it is rational at least to suppose that the lung cannot become a physiological dust trap and yet retain its elasticity." Yet, with our present methods of estimating disability, it is remarkable that the lungs appear to be able to hold large quantities of iron oxide without causing obvious damage. One of the purest forms of siderosis is that which occurs in welders, and Doig (1949) has summarised under five headings (clinical, pathological, experimental, statistical and radiological) the evidence which leads to the conclusion that welder's siderosis is not a disabling condition. On clinical examination of many hundreds of welders, Doig (1949) found that they have no dyspnoea or diminished capacity for work and no clinical evidence of pulmonary fibrosis. They have good chest expansions and exhibit a good tolerance for exercise. They not infrequently admit to having some cough and often some sputum, but in Doig's opinion (with which I agree) these are partly due to other factors and not merely due to deposition of iron oxide particles in the lungs. The pathological and experimental data have already been discussed. As regards statistical evidence, the Registrar-General in his Occupational Mortality Supplement (1938) shows that in 1931 amongst 11,542 welders and burners in England and Wales there were only 123 deaths, compared with 161 expected on the basis of the mortality rates of all males. Doig (1950) has also collated from various factories information regarding the sickness absence of welders compared with other workers, and he finds that welders compare favourably with other groups, not only for total sickness but also for respiratory illnesses in general. The work of Collen and others (1944) and Collen (1947) gives reliable evidence about the incidence of pneumonia in welders included in the 90,000 workers in the Kaiser Richmond shipyards in America. There was no increased incidence in welders, and the cases which did occur were similar in severity, course, and in the incidence of complications to those found in the other shipyard workers. As regards the prognosis as shown by the radiographic appearances, Doig and McLaughlin (1948) showed that in two of their original welders described in 1936 there was clearing of the abnormal X-ray shadows. One man who exhibited definite X-ray changes (nodulation) in 1934 (Fig. 12), and who gave up welding on being told about these changes, now has an X-ray picture of the chest within normal limits (Fig. 15). The other man, who had marked changes in 1933, continued to work as a welder, but became an instructor in 1940, thereby being less exposed to inhalation of the welding fume. His X-ray film now shows partial clearing of the abnormal shadows. This is in marked contrast with the

findings in cases of silicosis and asbestosis, in which the abnormal shadows tend to spread even if there is no more exposure to dust.

Other dusts which are considered to be inert and opaque to X-rays are tin, calcium and barium, but the evidence is not so complete as it is in the case of iron.

The X-ray picture of siderosis is one of the generalised reticular and nodular shadows over both lung fields. In some cases the shadows are so fine and granular as to constitute a ground-glass appearance. Up to the present time Doig and I have not seen a case in which there was coalescence of the nodular shadows. Again, this is in marked contrast with silicosis, in which coalescent or massive shadows are often found. But it is not possible, on radiographic evidence alone, to distinguish a case of "snowstorm" silicosis (Fig. 16) from the nodular form of welder's siderosis. Many other pathological conditions of the lungs have an X-ray picture which may be indistinguishable from that of siderosis or silicosis before the development of coalescent shadows. Some of these are miliary tuberculosis, sarcoidosis, beryllium granulomatosis, bagassosis, farmer's lung, aspergillosis, coccidio-mycosis and metastases from new growths. The practical lesson for radiologists and others is that when an X-ray film of the chest shows reticulation or nodulation, it should not be assumed that fibrosis or other pathological changes are necessarily present in the lungs. Collis (1950) puts the position neatly thus: "Many dusts may so modify the lung tissues that they furnish X-ray shadows; but all such shadows may not indicate a pathological pulmonary condition. And all pathological conditions which cast such shadows may not have been caused by inhaling dust." To make a diagnosis it is necessary to have in addition a complete occupational history, and the results of a thorough clinical examination. Even when the occupational history shows that there has been inhalation of the dust of iron and iron oxide, it is necessary to distinguish between pure siderosis, which is not disabling, and sidero-silicosis or sidero-fibrosis, which is a pathological condition and may be disabling. Examples of pure siderosis are found in welders (electric arc, carbon arc and oxyacetylene), makers of iron oxide, and in polishers of glass and silver who use powdered iron oxide in their work. Other groups not previously mentioned, such as billet and cotton card grinders, may also develop pure siderosis with the characteristic X-ray picture of the lungs. Sidero-silicosis occurs in hæmatite and other iron ore miners, boiler scalers, some categories of foundry workers, and in welders and oxyacetylene burners who work in foundry cleaning rooms. In sidero-siderosis, which belongs to the mixed dust pneumoconioses, the histological picture in each case may range from areas in which classical whorled silicotic nodules are present, to areas in which there are nodules of mixed dust fibrosis, and finally to areas in which there are aggregations of pigment without fibrosis.

### Summary

(1) Iron can be deposited in the lungs from (a) the inspired air (exogenous iron), resulting in siderosis, and from (b) the blood (endogenous iron or hæmosiderin), causing hæmosiderosis.

(2) In siderosis, the aggregates of iron are situated in the peribronchial

and periarterial lymph spaces, whereas in hæmosiderosis they are mainly intra-alveolar in position.

(3) No fibrosis is found in relation to the deposits of iron in cases of siderosis, but in hæmosiderosis a fibrous capsule develops round the aggregates of iron-containing siderophores.

(4) When a mixed dust containing iron or iron oxide and free silica is inhaled, a fibrosis of the lungs known as sidero-silicosis (or mixed dust fibrosis) may be found.

(5) Iron, both organic and inorganic, is opaque to X-rays, and aggregates of it in the lung tissues produce reticular and nodular X-ray pictures which resemble those seen in many other conditions. Coalescent and massive X-ray shadows are not seen in cases of pure siderosis.

(6) Siderosis should no longer be defined as a fibrosis of the lungs.

My thanks are due to the Editor of the *Lancet* for the loan of the blocks of Fig. 4(a), 4(b), and 4(c), and for permission to reproduce the illustrations and to the Editor of the *British Journal of Industrial Medicine* for permission to reproduce Figs. 8, 9, 10 and 11.

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The consumption of young men, that are in the flower of their age, when the heat of the blood is yet brisk, and therefore more disposed to a feverish fermentation, is for the most part acute. But in old men, where the natural heat is decayed, it is more chronic.

RICHARD MORTON: *Phthisiologia*, London, 1720.

The cure for phthisis is affected by taking a wolf's liver boiled in wine; the brain of a sow which has been fed upon herbs; or the flesh of a she-ass, eaten with the broth; the last more in particular being the one that is employed by the people of Achaia. Smoke of dried cow-dung inhaled through a reed is remarkably good for phthisis.

PLINY: *Natural History*.

## RENAL TUBERCULOSIS

BY ARTHUR JACOBS

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RENAL tuberculosis is encountered in three main clinical groups. In the first, tubercle bacilluria, the patient is a tuberculous sufferer who has a tubercle-positive urine but has no symptoms referable to the urinary tract. In the second, clinical renal tuberculosis, the symptoms are confined to the urinary tract and there is no obvious tuberculous lesion in the other systems. In the third, clinical renal tuberculosis associated with extra-urinary lesions, involvement of the urinary tract becomes manifest while a patient is undergoing treatment for pulmonary, bone, joint or other tuberculous disease or has formerly been treated for such a lesion which is quiescent. It will be convenient to consider in turn certain aspects from each of these groups.

## TUBERCLE BACILLURIA

Because of the absence of symptoms this subclinical form of urinary tuberculosis is generally recognised in sanatorium patients undergoing treatment for extra-urogenital lesions. A trace of albumen or some microscopic blood or pus cells in the urine having been found in the course of routine examination, subsequent search, possibly of repeated specimens, reveals tubercle bacilli either by acid-fast staining of the sediment, by guinea-pig test or by cultural methods. It is now generally accepted that a tuberculous patient cannot excrete tubercle bacilli through normal kidneys, and that the bacilluria indicates the presence of renal tuberculous foci of microscopic character. Medlar (1926) confirmed this when he studied by serial section the kidneys removed at autopsy from patients who had died of extra-urinary tuberculosis. He found microscopic lesions present in both organs of the thirty cases thus examined. In a long-term combined clinical and pathological investigation, Band (1942) found a tubercle bacilluria in 21.3 per cent. of 300 sanatorium patients who had extra-urogenital tuberculosis. He examined by serial section the kidneys of 30 patients who had died without any signs or symptoms pointing to involvement of the urinary tract, and found minute cortical foci in relation to the glomeruli in all cases. These tiny foci, in every stage of development from an early tubercle to a healed scar, were never visible to the naked eye.

From the clinical aspect the important point to be appreciated in dealing with this form of renal tuberculosis is that such lesions can and frequently do heal. Band found that the tubercle bacilluria was temporary in 23.4 per cent., the disappearance of the infection being associated with the healing of the extra-urogenital lesions. Nevertheless, as is occasionally demonstrated at Robroyston, where complete urological investigation of all cases exhibiting tubercle bacilluria is routine, an established renal focus may sometimes follow the bacilluria. It is at this stage, therefore, that the therapeutic measures



against the extra-urinary lesions known to exist are likely to prove most effective in preventing the microscopic subclinical renal lesion from developing into a frank clinical focus.

#### CLINICAL RENAL TUBERCULOSIS

Patients in this category are generally first encountered in the urological out-patient department, being referred there because of a persistent urinary infection and symptoms of cystitis. Although exhibiting no apparent evidence of extra-urinary tuberculosis, they are nevertheless suffering from a visceral manifestation of a previously acquired infection of respiratory or intestinal origin. The kidney, infected through the blood stream from either of these sources, is the primary site of the urinary tract involvement, though never the primary focus of the tuberculous process. It is the secondary infection of the bladder resulting from a descent of the tubercle-infected urine from the diseased upper urinary tract that is responsible for the symptoms. Thus once these have commenced in a patient with pyuria and a tubercle-positive urine an open established renal lesion of the ulcero-cavernous or caseo-cavernous type will be found. Systematic examination is required for evidence of extra-urinary foci. Routine chest X-ray will reveal a moderately high incidence of previous intrapulmonary infection.

#### CLINICAL RENAL TUBERCULOSIS ASSOCIATED WITH EXTRAURINARY LESIONS

From what has just been written it will be apparent that everyone with renal tuberculosis has an associated extra-urinary lesion, even though this be latent or quiescent. The group now under discussion suffers from active pulmonary, intestinal, bone or joint disease or a combination of these maladies, which can be readily demonstrated by clinical and radiological examinations; alternatively they have a history of having suffered from such lesions which were deemed to have become quiescent. Close co-operation between the tuberculosis physician and the urologist is of particular importance when dealing with patients in this group, especially when the extra-urinary lesion is a pulmonary one. With both systems affected, toxæmia, as evidenced by pyrexia, tachycardia, night sweats, loss of appetite and weight, pallor and an increase in the sedimentation rate, is generally the result of the pulmonary infection, the care of which must in consequence be given precedence.

#### EXAMINATION OF THE URINARY TRACT

In all patients with a tubercle-positive urine urological investigation is indicated to ascertain whether the renal infection is unilateral or bilateral, the extent of the lesion or lesions and the degree of bladder involvement. The following routine is employed to obtain this information.

A straight X-ray of the complete urinary tract is first made. This by itself may reveal evidence of tuberculous disease by showing areas of calcification within the renal shadow and also along the ureter. Sometimes the whole kidney is seen as an enlarged caseous or calcified mass.

Intravenous pyelography, the next step of the examination, is of inestimable value and may, by itself, supply all the essential information required. An

absence of the pyelographic medium, a delay in its appearance, or a persistent poor concentration will indicate the affected side if the other concentrates well and exhibits a normal outline. Pathognomonic demonstration of a destructive focus such as the erosion of a calyx, or, with a more advanced lesion, cavitation involving the kidney parenchyma, are often recognised. Thus in the average case with unilateral disease intravenous pyelography will show which kidney is affected, may demonstrate the extent of the lesion and indicate the presence of a healthy organ on the contra-lateral side. To confirm this it is generally advisable to obtain a specimen of urine from the apparently healthy kidney for direct smear examination and animal inoculation. To know that the excretion from that side is free from pus and tubercle bacilli is reassuring, particularly in regard to the later prognosis. In any event, it is highly desirable to have the information which only a cystoscopic examination can provide. This therefore is the next step in the investigation. The bladder capacity, the appearances of the two ureteric orifices, the presence of tubercles or the ulceration which is their sequel, are particularly noted. A catheter is then passed up the ureter of the apparently healthy kidney and a specimen from that side is collected. If all the information desired from pyelography has not been obtained by the intravenous method, a retrograde pyelogram can now be made to confirm the absence of disease. Similarly, if it is deemed necessary to confirm the presence of disease on the other side, both ureters should be catheterised and bilateral retrograde pyelograms taken. Sometimes a stricture at the lower end of the ureter on the diseased side will render this step impossible, and even on the good side inflammation of the bladder wall involving and constricting the ureteric orifice may result in obstruction to the passage of a ureteric catheter. A constriction of this nature may result in a hydro-ureter and hydronephrosis and give an erroneous impression of bilateral disease.

A full urological investigation such as outlined, if carried out with care, can be given to the majority of patients without upset. It should not therefore be withheld from those with tubercle-positive urines, because of the existence of pulmonary disease, for in some a urinary focus will be discovered which may be responsible for toxæmia, the elimination of which will aid the control of the lung infection.

#### OPERATIVE INTERVENTION

The treatment of urinary tuberculosis, as of tuberculosis affecting other systems, is best carried out in a sanatorium or in a hospital where analogous conditions prevail. There, when the patient has reached the optimum state likely to be achieved from rest, fresh air and nourishing food, operative intervention if indicated can be deliberately planned. The objective of nephrectomy is the removal of the focus responsible for the persistent reinfection of the bladder. The operation should be regarded as but one of the steps in treatment, and is seldom a matter of urgency unless complicating factors arise. Thus, a superadded pyogenic infection causing toxæmic symptoms, or the development of a gross tuberculous pyonephrosis which might rupture or give rise to a perirenal abscess, would hasten the need for intervention.

While it is undesirable to lay down the indications for operation too rigidly, it can be said that if the urological investigation shows obvious disease on one side and a normal uninfected kidney on the other, the diseased kidney should be removed; while if the investigation reveals established lesions in both kidneys nephrectomy is generally contraindicated. If, nevertheless, one kidney is grossly diseased and the other exhibits a small lesion, removal of the worst kidney may be beneficial in eliminating one focus responsible for a constant discharge into the bladder of grossly infected urine. In the event, however, of the lesion in the remaining kidney continuing to progress, little or no amelioration may result. A wise plan to adopt for bilateral disease of this category is to keep the patient under observation in the best possible conditions for several months and to administer a full course of streptomycin. If the follow-up pyelographic examinations indicate that the lesion in the better kidney is stationary, removal of the other can be carried out; if the lesion is progressive, no operation is advisable.

Some surgeons advocate the routine removal with the kidney of the entire ureter down to the bladder, claiming that this diminishes the incidence of sinus formation and hastens the resolution of the secondary cystitis. With an experience of over 300 nephrectomies for renal tuberculosis when a coincidental or subsequent removal of the ureter was performed only on selected cases with pronounced involvement of the tube, I am of the opinion that nephroureterectomy does not ensure against these sequelæ. In consequence I reserve this more radical procedure for those whose ureters exhibit obvious macroscopic changes. The tendency in recent years at certain centres has in fact been in the direction of diminishing the scope of operation and in cases with limited lesions to carry out only a partial nephrectomy. A solitary focus, particularly when confined to an upper or lower pole, can be completely extirpated by this method, and the use of streptomycin before and after the operation reduces the risk of wound contamination and sinus formation. This conservative measure offers the possibility of removing an infected segment from the solitary kidney of a patient who has previously undergone nephrectomy.

Reference has already been made to the more urgent needs of an active lung lesion than a renal one when both are simultaneously present. The life-taking pulmonary disease must be controlled before any surgical intervention on the urinary tract can be considered. Spread to healthy lung tissue is quicker and of greater danger than a corresponding spread in kidney tissue. Infected sputum is likely to involve additional areas of the lung, the bronchi and larynx, and the swallowing of sputum may infect the intestinal tract. Infection from a diseased kidney, on the other hand, is more likely to remain within the affected system. A hæmatogenous spread to other systems is of course a possibility from either source. Evidence of the control of a pulmonary lesion, usually after some form of collapse therapy, is assessed by the general condition of the patient, absence of toxæmia, serial chest X-rays and sputum conversion. Quiescence of the lung disease as ascertained by these measures is aimed at for a period of at least three months prior to surgical intervention on the renal lesion. It is then considered relatively safe to proceed with a nephrectomy even in patients who have had artificial pneumothorax, pneumoperitoneum, thoracoplasty or extra-pleural pneumothorax.

## STREPTOMYCIN IN RENAL TUBERCULOSIS

Under the auspices of the Tuberculosis Research Unit of the Medical Research Council, a controlled trial of streptomycin therapy for tuberculous disease of the urinary tract has been in progress at Robroyston Hospital for over two years. A preliminary report giving the results obtained after the first fifteen months, by which time 90 patients had been studied, has already been made (Jacobs and Borthwick, 1950). Streptomycin was given to 46 patients and 44 were used as controls. In order to assess the results as accurately as possible patients are divided into the following five categories:

Group 1: Unilateral renal tuberculosis—minor lesion without cystitis.

Group 2: Unilateral renal tuberculosis—major lesion necessitating nephrectomy: cystitis.

Group 3: Bilateral renal tuberculosis—nephrectomy for the more advanced lesion.

Group 4: Tuberculosis occurring in the remaining kidney subsequent to nephrectomy for unilateral disease.

Group 5: (a) Major bilateral tuberculous lesions.

(b) Minor bilateral tuberculous lesions.

The course consists of 1 gramme of streptomycin daily, given in two intramuscular injections for ninety days. Control and streptomycin-treated patients receive similar general medical treatment. The conclusions reached after observation on the effects of the therapy, as ascertained by repeated bacteriological assays and follow-up cystoscopic and pyelographic studies, can be summarised as follows: Streptomycin has no effect on an established caseo-cavernous lesion. By encouraging fibrosis and consequent constriction there is a possibility that the focus, though remaining active, may become shut off. A regression of the constriction can, however, occur. Streptomycin therapy cannot therefore be recommended to supplant surgery, and in clinical unilateral renal tuberculosis the diseased kidney should be removed. A patient unsuitable for surgery should not automatically be given streptomycin. Thus, when there is an advanced bilateral lesion or an advanced lesion in a solitary kidney, no improvement in the kidney lesion can be anticipated, and, as was found in some instances, vesical contracture may as a result of fibrosis be hastened. The treatment in consequence can cause an actual worsening of the clinical state. The category chiefly benefiting comprised those with a unilateral renal lesion and cystitis who had been nephrectomised (group 2). The secondary cystitis cleared and the urine became tubercle negative in an appreciably larger number of streptomycin-treated than control cases. A further year's experience with streptomycin therapy has not altered these opinions.

## BLADDER CONTRACTURE, HYDRONEPHROSIS AND HYDRO-URETER

In most unilateral cases of renal tuberculosis a marked improvement in the secondary cystitis with a corresponding relief of bladder symptoms follows the nephrectomy. This amelioration may be rapid, but more often the process is gradual, and up to six months or even longer may be required before the maximum improvement occurs. The time needed for this is an additional reason

for a prolonged post-operative sanatorium régime. When the expected resolution of the tuberculous cystitis does not take place, by no means a rare occurrence even when the remaining kidney is completely free from infection, a serious aftermath has to be dealt with. It is most likely to arise in those patients who have developed interstitial changes in the bladder walls before operation. Mention has been made of the complication arising or becoming aggravated with streptomycin therapy. The thimble-like bladder capacity which can finally develop causes painful bladder spasm, compels the voiding of urine every fifteen to twenty minutes night and day, and ultimately there may be total incontinence. Furthermore a hydronephrosis of the remaining kidney and a hydro-ureter even of dimensions approaching that of small bowel, as I have encountered on several occasions, is liable to occur as a result of back pressure from the contracted bladder or from stricture at the lower end of the ureter. The consequent progressive renal impairment which necessarily follows may finally culminate in uræmia and death. A similar state of affairs can of course arise when the remaining kidney is the seat of, or later develops, a tuberculous focus and from bilateral renal tuberculosis. The only way of relieving these sufferers and saving a kidney threatened with destruction from back-pressure is to divert the urine from the bladder. With a solitary non-tuberculous kidney, transplantation of its ureter into the bowel is the most desirable method of accomplishing this. Following the operation urinary control is generally excellent, with intervals of several hours between the acts of rectal urination. A remarkable degree of resolution in the pre-existing dilatation of the renal pelvis and ureter can often be demonstrated in post-operative follow-up intravenous urograms. The symptomatic relief obtained by those who formerly suffered from constant frequency and vesical tenesmus is such that requests for a transplant are sometimes made by patients on their own initiative after they have seen the effects of the operation on their fellow patients.

When an intractable contracture occurs in a patient with a solitary kidney that is the seat of established disease, or with both kidneys so affected, and the bladder symptoms are in consequence intolerable, cutaneous ureterostomy is the safest and simplest method of deviating the urine. Because of the need to wear a urine-collecting apparatus, the procedure is, however, less desirable than uretero-colic anastomosis.

#### MALE GENITAL TRACT TUBERCULOSIS

Any review of renal tuberculosis would be incomplete without referring to tuberculosis of the genital tract in the male. Prolonged clinical investigation by Borthwick (1945) has indicated that in the great majority of cases the genital lesion is in fact a sequel to a renal one. The infection descends from the kidney, and the seminal vesicles and prostate next become involved from contaminated urine in the posterior urethra. Disease of the epididymis then occurs as a result of spread by way of the vas lumen. When therefore an indurated, enlarged nodular epididymis with a thickened vas points to the presence of a genital lesion, pelvic examination will reveal a vesiculitis and prostatitis, and investigation of the upper urinary tract will show a clinical renal focus in more than 50 per cent. of these patients. Borthwick believes that those exhibiting no evidence of a renal lesion have formerly suffered from one which has been of



the subclinical variety and has healed. Accordingly a tuberculous epididymitis should be regarded as a sign of renal tuberculosis, and every case should have a full urological investigation. The confirmation of a coincidental renal lesion will necessitate the régime outlined for this disease, and in addition epididymectomy is generally advisable. When the epididymitis is unilateral, vasectomy of the healthy vas should also be performed if the corresponding seminal vesicle feels indurated in order to prevent spread to the remaining epididymis. When the epididymal lesion is bilateral both epididymes should be removed.

In renal tuberculosis associated with a genital involvement the prognosis is less favourable.

### Conclusions

As renal tuberculosis is a focal manifestation of a systemic disease, investigation of patients suffering from this infection must not be confined to the genito-urinary tract, but all systems must be examined. When pulmonary tuberculosis is coexistent priority should be given to the steps necessary to control this more serious lesion. If removal of a kidney is indicated the operation should be regarded as one measure only in the treatment, which should follow the lines of a full sanatorium régime. Streptomycin or other antibiotics cannot heal an established renal tuberculous focus, though they may aid the control of certain complications arising from it. In uncontrolled cases with irreversible vesical contracture, relief of symptoms can be obtained by deviating the urine from the bladder, preferably by the method of uretero-enterostomy.

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The sun is the greatest of remedies.

PLINY: *Natural History*.

Consumptive People are likewise generally observed to be very quick, full of Spirit, hasty, and of a sharp ready Wit, and are commonly very impatient, and tenacious of the least Disrespect that is shewn them . . .

BENJAMIN MARTEN: *A new theory of consumptions*, London, 1720, p. 5.

## “THE HOME TREATMENT OF PRIMARY TUBERCULOSIS IN CHILDREN”

BY MARCIA HALL

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### INTRODUCTION

WHENEVER pædiatricians and chest physicians meet it quickly becomes obvious that there is a considerable divergence of opinion about the correct management of children suffering from primary intrathoracic tuberculosis and its immediate sequelæ. Indeed, it is hardly an exaggeration to say that, unless the chairman is endowed with considerable skill and tact, such a meeting is apt to deteriorate into an acrimonious argument.

On the one hand there are the pædiatricians, who, remembering their cases of miliary tuberculosis and tuberculous meningitis, are so afraid of these complications that they exaggerate the potential danger to the child with his primary complex, and tend to keep him in bed for an excessively long period—or if not actually in bed, at least hospitalised—and at the end of many months in hospital to transfer him elsewhere for further institutional treatment rather than sending him home. At the other end of the scale we have the chest physician who says: “This child is already infected, a further dose of tubercle bacilli will not hurt him, his resistance must now be very high. In any case, treatment will not affect the ultimate result.” Between these two extremes lies every shade of opinion.

Is the primary infection a dangerous period in a child's life demanding hospitalisation? Or is it unimportant, benign and self-limiting?

I submit that, unless the home conditions are extremely unsatisfactory, the evidence of the value of long periods of hospitalisation is inconclusive.

### LITERATURE

If we regard rest as the one part of the treatment of primary intrathoracic tuberculosis that is of paramount importance, we again encounter two schools of thought:

- (a) That rest in bed during the infiltrative phase of the Primary complex hastens recovery and diminishes complications.
- (b) That no treatment modifies the Primary infection in any way.

The first view is that of Prof. Wallgren, 1945, who is a firm believer in rest as essential in treatment. He is particularly at pains to show that Levine, 1944, whose figures show that a large group of children who had no rest, were in no way worse as a result, did not compare exactly comparable groups.

Wallgren points out that the age of the child at the time of infection, and the age of the infection itself in any given child, are both factors of such importance

that they must be taken into account in any study of results of treatment, and he therefore regards Levine's deduction that unrestricted activity is no way detrimental to the final outcome as unsound.

In the prognosis Myers, 1938, regards the age of the child at the time of infection as of greater importance than rest. He would limit bed rest to the time during which the child has a raised temperature, and not continue it simply because the child has a raised sedimentation rate.

#### AIMS OF THE TUBERCULOSIS CLINIC

In July 1948 at the Hospital for Sick Children a Tuberculosis Clinic was started in the Outpatient Department, the chief aim of which was to elucidate, if possible, the question of the necessity for prolonged hospital treatment in cases of primary infection.

There were two particular reasons for wishing to make an effort to send children home at an earlier date. Firstly, from the child's point of view: prolonged hospitalisation is psychologically bad for the child; it interrupts his normal schooling, if he is of school age, and it estranges him from his family. Secondly, from the hospital's point of view: we found our beds at the Country Branch blocked for months on end by these cases, which meant fewer children could be treated; and if we tried to send them on to sanatoria and convalescent homes, again there was a delay of many months. Was it really necessary? And how far have we succeeded in keeping our beds clearer and thereby increasing their usefulness?

It is hardly necessary to say that we realise there can be no definite answer for a good many more years, but after two and a half years' work we felt that the results were worth recording if only to suggest to others responsible for cases of primary tuberculosis in children's hospitals and wards that they might venture to try the effect of earlier return home.

One further point; we must emphasise that the Tuberculosis Clinic does not by any means see all cases of tuberculosis attending the Hospital for Sick Children or passing through the wards, nor are the views expressed necessarily held by all our colleagues at the hospital.

First, to what extent has the new policy reduced the length of stay in hospital of our cases?

The following figures apply only to cases admitted to the Country Branch:

TABLE I  
*February 1946—July 1948*

Total cases admitted	..	..	..	73
Pulmonary ..	..	..	..	67
Extra-pulmonary ..	..	..	..	6
In hospital under 1/12	..	..	7	9.5 per cent.
"    "    3/12 or under	..	..	13	17.8 " "
"    "    6/12 or under	..	..	24	33.0 " "
"    "    6/12 but under 1 year	..	..	19	26.0 " "
"    "    over 1 year	..	..	4	5.4 " "
Discharged home ..	..	..	44	50.2 " "
"    elsewhere	..	..	23	31.5 " "
Died ..	..	..	6	

TABLE II

July 1948—December 1950

Total cases admitted	..	..	..	151	
Pulmonary	..	..	..	142	
Extra-pulmonary	..	..	..	9	
In hospital under 1/12	..	..	..	76	50.3 per cent.
" " 3/12 or under	..	..	..	34	22.7 " "
" " 6/12 or under	..	..	..	32	21.1 " "
" " over 6/12 but under 1 year	..	..	..	8	5.03 " "
" " over 1 year	..	..	..	1	0.66 " "
Discharged home	..	..	..	124	82.1 " "
" elsewhere	..	..	..	27	17.08 " "
Died	..	..	..	0	

It will be seen that, in the period July 1948—December 1950, 151 cases were admitted—142 pulmonary, 9 abdominal; we have omitted from these figures cases of tuberculous cervical adenitis and also orthopaedic cases, unless these were also accompanied by intrathoracic disease. In the period February 1946 to July 1948 only 73 cases were admitted, 78 fewer than in the later period. This can be partly explained by the fact that so many cases in the larger group were in hospital for only very short periods, and therefore there was a greater use of beds. It may also be partly due to the existence of the Tuberculosis Outpatient Clinic, which increased the number of tuberculous children under observation, and gathered many more of them together in one department of the parent hospital.

Whereas before the adoption of our new policy 9.5 per cent. only of the admissions were in hospital under one month, afterwards 50.3 per cent. were in under one month, and at the other end of the scale only 0.66 per cent. were in hospital over a year, whereas 5.4 per cent. in the earlier group were in over a year.

From 1946 to 1948 only 50.2 per cent. were discharged home and 31.5 per cent. discharged elsewhere. From 1948 to 1950 82.1 per cent. were discharged home and only 17.08 per cent. elsewhere.

With regard to the six deaths noted in the earlier period, this is explained partly by the increasing efficacy of streptomycin treatment in children with hæmatogenous spread, and partly by the fact that latterly the majority of children who have relapses of their tuberculous meningitis have returned to the parent hospital for the early stages of their treatment and therefore appear as "discharged elsewhere." In fact, no in-patient children with primary disease have developed meningitis in Tadworth between 1948 and 1950.

Of the children discharged elsewhere, some have gone to Highwood Hospital, others to residential open-air schools, others to Nurseries or Convalescent homes, usually because of the continued presence of the infecting agent at home, sometimes because of very unsatisfactory housing with large families in which the mother was unable to give sufficient attention to the child, so that he could not return home until he was considered fit for a more or less normal life in the family.

The reasons for the short-term admissions in the following order of frequency were:

1. Tonsillectomy and adenoidectomy.
2. Bronchoscopy.

3. Failure to progress, usually due to mismanagement at home. Refusing to rest or to eat, etc.
4. Difficult home conditions—mother going out to work, overcrowding, etc.
5. An adult in the home with active pulmonary tuberculosis.

Of these the first two often meant a stay of under a week: the last two more often meant a stay of over a month.

With regard to the third group, we have found that three weeks to a month in hospital is a great help in starting the children on the road to recovery. It gives the mothers a rest, and at the same time teaches the child a little discipline. His sedimentation rate is usually normal or coming down in this length of time and he has begun to gain weight.

#### THE WORK OF THE OUT-PATIENT CLINIC

In addition to the 151 cases admitted to Tadworth since the out-patient clinic started, and already discussed, there have been a further 89 children who have been treated entirely as out-patients: a total number of 240 children attending the clinic, with 1,711 visits to hospital. Children discharged from hospital automatically continue their supervision in the out-patient clinic.

Of these 89 children there have been two deaths.

#### CASE HISTORY 1

C. H. Age  $3\frac{1}{2}$ . Only child. Father and Mother well. No known contact discovered. Good housing, mother able to devote all her time to the child. Pertussis, September 1947. Cough since. Admitted Hospital for Sick Children 16.4.1948-1.5.1948. Diagnosis of primary intrathoracic tuberculosis with collapse and consolidation of the R.U.L. and R.L.L. Thereafter supervised as an outpatient. Never made very great progress, in thirteen months weight gain  $4\frac{1}{2}$  lb., but there was some resolution of the intrathoracic lesion. Readmitted 4.5.1949 with meningitis. Died 16.8.1949, in spite of intensive treatment with streptomycin. Permission for autopsy not obtained.

#### CASE HISTORY 2

D. W. Age 5 years 9 months. Father and mother well. One brother  $3\frac{1}{2}$  also well. Tonsils and adenoids removed for otorrhœa. Penicillin injections afterwards, the last into the L. deltoid. Seen September 1948 in Surgical Outpatients. Small ulcerated area over site of injection. Penicillin cream applied. October 1948: abscess in axillary gland opened in Outpatients. No growth from pus. October 19: seen by Mr. Denis Browne, who considered the granulations at site of original injection looked tuberculous, and referred him to physician. Jelly test positive. X-ray: chest, some collapse at L. base and enlarged R. hilar gland. December 23: seen in Tuberculosis Clinic for the first time. Very nervous boy, complaining of vague pains all over. No signs of meningitis. X-ray unchanged. Notified, and told to attend again on January 10. January 11 seen at Chest Clinic, Edmonton, where no evidence of tuberculous infection of the lungs was found. Referred again to us. January 11 evening: admitted to N. Middlesex Hospital with convulsions. January 12: died. Post-mortem: Miliary tuberculosis, tuberculous meningitis and a small tuberculoma of brain.



## POLICY

One other child developed meningitis as an outpatient. She was seen within three days of having symptoms and admitted. She is now alive and well and at school.

As soon as a child attends the clinic and is definitely diagnosed as suffering from primary intrathoracic tuberculosis, he is notified, and a covering letter is sent with the form to his Chest Physician asking for investigation of family and whether he agrees to the child continuing supervision by us, also offering B.C.G. vaccination to negative children in the family unless he prefers to do it himself. Occasionally the mother prefers to be transferred at once to her nearest chest clinic and not to attend hospital again.

At the clinic the mother is told certain things—the nature of the disease is explained and her anxieties allayed as far as possible; but she is warned that at any time if she is anxious about the child she must get in touch with us, and bring him up to hospital. She is to take notice of such things as headache, vomiting, lack of energy or excessive irritability. In fact, we have found it is usually for upper respiratory infection and coughs that mothers seek an earlier appointment.

If the child has a high sedimentation rate she is asked to keep him in bed, except for going to the lavatory and washing, until her next visit.

Most of the children come again in three weeks to one month, and as soon as possible we try to get them on to this sort of régime: Up 10 a.m.; bed 6 p.m.; midday rest after dinner, 1½ hours.

We stress the importance of cod-liver oil, and if over 5 years prescribe this or halibut-liver oil. Under 5 years of age the child is entitled to cod-liver oil on his ration book, and we urge the mother to collect it from her nearest depot and see that the child takes it regularly. We also prescribe calcium gluconate.

As soon as the X-ray appearances show evidence of healing, whether there be a segmental collapse or not, and the child is gaining weight, we return him to school, believing that many children get more rest attending school than at home all day. We keep up the midday rest at week ends and often in the earlier stages ask for attendance at morning school only, so that the afternoon rest can be continued daily for rather longer.

When a child's lesion is resolving we decrease his number of visits to three months, then six months, and finally to a yearly one, always telling the mother to come sooner if she feels he is not maintaining his progress.

## RESULTS

With the exception of the two deaths already mentioned, there has been steady improvement in the 89 children. Eighteen are now sufficiently calcified to warrant making no further appointments for regular supervision. The rest are still under regular supervision. Nineteen children of the remaining 240 who began treatment as outpatients, have had to be admitted for a short period to hospital as they did not seem to be progressing as well as we thought they should. Five of these were transferred elsewhere, the other 14 returned home again. We append the histories and photographs of three typical cases treated entirely as out-patients and chosen particularly for their age. Many authorities believe

PLATE XV.



FIG. 1.—J. T. (i)

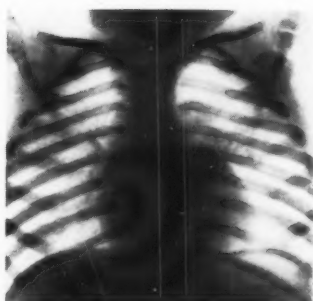


FIG. 2.—J. T. (ii)

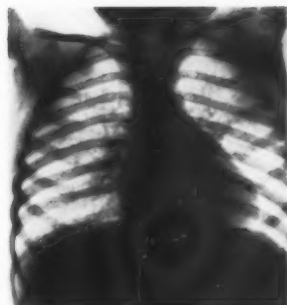


FIG. 3.—J. T. (iii)

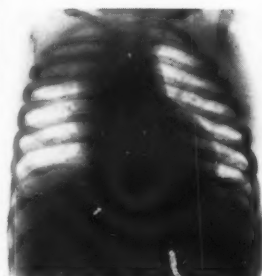


FIG. 4.—R. S. (i)

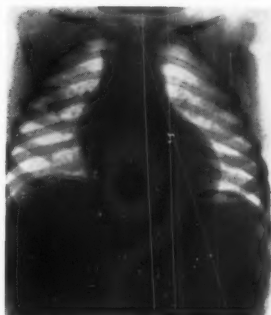


FIG. 5.—R. S. (ii)

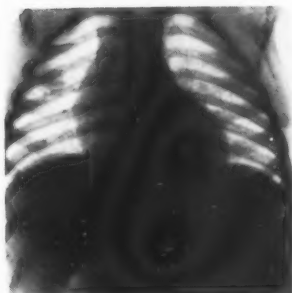


FIG. 6.—R. S. (iii)



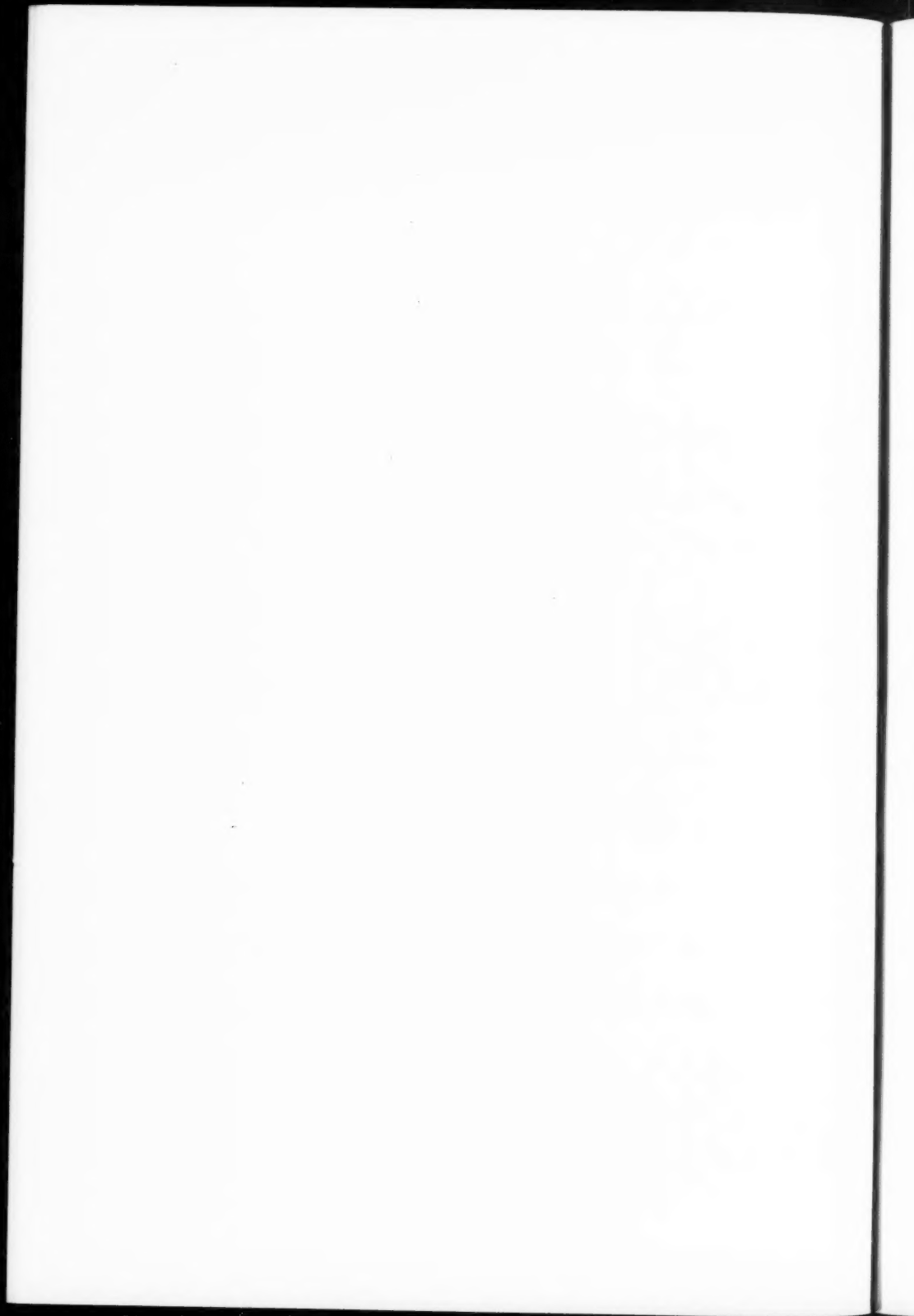
FIG. 7.—V. O. (i)



FIG. 8.—V. O. (ii)



FIG. 9.—V. O. (iii)



that very young children should be hospitalised, and these are examples of young children who have done well at home.

#### CASE HISTORY 3

J. T. Age 18 months. Father and mother well. Only child. Maternal grandfather has Pulmonary tuberculosis and the family all live together. Attended first November 1948 with cough. Positive skin test, consolidation in L.M. zone and sedimentation rate 26 mm. in first hour. Family re-housed March 1949. Steady progress. Gained 4 lb. in first year; second year  $4\frac{3}{4}$  lb. Now has calcified lesion at left hilum and some emphysema of L.L.L.; this, however, proves on screening not to be obstructive.

#### CASE HISTORY 4

R. S. Age 1 year, 5 months. First seen April 1949. Father has had pulmonary tuberculosis one year and been in a sanatorium. Mother well. Only child. Child supervised at local chest clinic ever since. In October his skin test became positive. In April 1949 he developed collapse and consolidation of R.U.L. Strongly recommended for institutional treatment by Chest Physician. Supervised in clinic, and has made good steady progress. Some calcification began to appear in lung lesion by October 1949—*i.e.*, six months after the first evidence of his primary infection became visible radiographically.

#### CASE HISTORY 5

V. O. Age  $4\frac{1}{2}$  years. Mother died August 1948 of Pulmonary Tuberculosis. Father well. Brother 6, sister  $2\frac{1}{2}$  years. Unsatisfactory home conditions. Youngest child living with grandparents. Two boys given breakfast by neighbour on ground floor, go to school and wait about, often in the streets, until father returns from work to give them an evening meal. Father absolutely refuses institutional treatment for V. O. First seen March 1949. Collapse and consolidation R.U.L. Skin test positive. Sedimentation rate 15 mm. in first hour. Weight gain at first was variable; there were moist sounds over upper lobe, and no improvement until August 1949, then lesion began to resolve. Now well calcified. Father has married again recently and the family are all well cared for and supervised now in the clinic.

#### Discussion

The figures given above demonstrate that we have succeeded in our aim of keeping our tuberculosis beds at the Country Branch clearer, and thereby increasing their usefulness.

With regard to our second question, the success of home treatment for cases of primary tuberculosis, we submit that two deaths, of which one was in an atypical case, is no higher a mortality rate than might be expected to occur in hospitalised cases. For no one has yet evolved any method of predicting which cases will succumb to hæmatogenous spread, and indeed often those whose radiographic appearances are by no means the most severe do in fact develop complications. We do not agree with Levine that rest makes no difference to these children's progress, but we believe that very many children could get sufficient rest at home. There is only one real difficulty, the presence of an adult with open phthisis in the household. In those cases we always remove the infected child, believing that, while he is himself coping with his own infection, to continue to bombard

him with more virulent organisms cannot be wise or safe. We have, however, returned children to such homes when they are themselves well, and by radiography their lesions show good calcification, even if the process of healing is not complete. The negative cases we segregate and vaccinate with B.C.G., only returning them home when they are Mantoux positive, and we are satisfied that home conditions are fairly reasonable. For example, we would not expect B.C.G. to give a child so high a resistance as to render him safe to share a bed with an infectious adult, but we do believe that if the adult understands the rules of hygiene the vaccinated child has that added protection which renders it safe for him to live at home.

In conclusion, we plead for the home treatment of a larger number of children with primary intrathoracic tuberculosis, or if admission to hospital becomes necessary, it should be for short periods only. We feel that this investigation might well be of very wide significance. If more physicians adopt the home treatment of primary tuberculosis, then it will follow that there will be a diminution of children's convalescent beds for this particular disease. Surely a desirable result when Regional Hospital Boards are all anxious to effect whatever economies they can?

#### Summary

1. Figures are given of the number of cases of primary intrathoracic tuberculosis treated at Tadworth Court, Surrey, between February 1946 and July 1948, and between July 1948 and December 1950.
2. Figures are given of cases treated entirely as out-patients between July 1948 and December 1950.
3. The work of the outpatient clinic is discussed.
4. A case is made for treating more children at home or for much shorter periods in hospital.

I desire to thank the Medical Committee of the Hospital for Sick Children for permission to publish this article; and particularly Doctor Wilfred Sheldon for his ever-ready help and advice, and access to his cases at Tadworth Court. Also Dr. Joan d'Arcy for her help in preparing the tables and Sister Smith for all her help with the clinic.

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## THE DEVELOPMENT OF A SPONTANEOUS PNEUMOPERITONEUM DURING ARTIFICIAL PNEUMOTHORAX THERAPY

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From the Harrow Chest Clinic, N.W. Metropolitan Regional Hospital Board

THE occurrence of a spontaneous pneumoperitoneum as a complication of artificial pneumothorax therapy is believed to be sufficiently uncommon to warrant placing on record the details of the following case.

The patient, a male aged twenty-three, had pulmonary tuberculosis with cavitation involving the middle zone of the right lung. After two months' bed rest a right phrenic crush was performed followed by induction of a pneumoperitoneum. Two months later a right artificial pneumothorax was induced and, following pneumonolysis, the pneumoperitoneum was abandoned. Just before discharge from sanatorium a right phrenic avulsion was performed.

The artificial pneumothorax was maintained without difficulty for the next six months, refills being done weekly through the third intercostal space in the anterior axillary line. One day, six months after the phrenic avulsion and about five hours after a refill, the patient experienced a sudden tearing sensation in the abdomen followed by the same vague feeling of discomfort which he had experienced during artificial pneumoperitoneum therapy. He attended the clinic two days later, when examination failed to reveal any evidence of surgical emphysema, but screening showed a very shallow right artificial pneumothorax and air below the diaphragm. There was no fluid in the right pleural sac nor was there any evidence of mediastinal emphysema.

The following are the weekly pressures and amounts of air given for the six refills up to an including the one followed by the development of the pneumoperitoneum.

<i>Initial Pressure</i>	<i>Amount of Air in c.c.</i>	<i>Final Pressure</i>
- 10 - 4	300	- 8 - 3
- 10 - 4	350	- 8 - 3
- 13 - 5	600	- 8 - 2
- 16 - 10	600	- 8 - 4
- 15 - 9	500	- 8 - 2
- 10 - 5	500	- 6 - 3

It will be observed that at no time was the pressure in the pleural sac above zero.

The pneumoperitoneum absorbed steadily, while refills of the artificial pneumothorax were continued at weekly intervals. The artificial pneumothorax was eventually abandoned as ineffective, owing to the formation of extensive adhesions, when most of the air escaped into the peritoneal sac.

The occurrence of a spontaneous pneumothorax, usually on the right side, as a complication of artificial pneumoperitoneum therapy, has been described

several times (Banyai, 1946; Simmonds, 1946; Mellies, 1939). This occurrence, when refills have been done through the anterior abdominal wall and not through the lower intercostal spaces, has been ascribed to:

- (1) Air entering the mediastinum from the abdomen and thence bursting into the pleural space (Simmonds, 1946).
- (2) Defects in the peritoneal covering of the under surface of the diaphragm (Laird, 1945).
- (3) The passage of air alongside one of the mediastinal structures passing through the diaphragm (Banyai, 1946).
- (4) The abnormal persistence of a pleuro-peritoneal canal (Sita-Lumsden, 1949).

In all these cases, and in the two cases already described of a pneumoperitoneum developing during artificial pneumothorax therapy (Banyai, 1943), the air contained in the original cavity has been at a positive pressure, whereas in the case here described the pressure was negative.

Anatomically the diaphragm is a complex structure with a fourfold origin: (1) Its central portion from the septum transversum, (2) its lateral parts from the pleuro-peritoneal membranes, plus (3) derivatives from the body wall and (4) a median dorsal portion from the dorsal mesentery. Defects in this structure occur from imperfect development of the pleuro-peritoneal membrane and are usually found on the left side. The passage of air through such a defect would be facilitated by a phrenic avulsion with its consequent muscular atrophy, although why air should pass through such a defect on only one single occasion is not evident, since no pleural exudate developed which could have sealed the opening.

It is presumed that the defect did not become evident while the artificial pneumoperitoneum was originally present, owing to some muscle tissue still remaining following the phrenic crush. After the phrenic avulsion had been performed the muscular tissue would atrophy completely (since it is questionable if the lower thoracic nerves have any share in the motor innervation of the diaphragm), and the rise in intra-pleural pressure which occurs during coughing could be sufficient to cause air to leave the pleural space and pass into the peritoneal sac.

### Summary

A case of spontaneous pneumoperitoneum occurring during artificial pneumothorax therapy is described. The cause of this is presumed to be a developmental defect in the diaphragm which only became evident following muscular atrophy occurring as a result of the operation of phrenic avulsion.

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## A REVIEW OF 100 CONSECUTIVE CASES OF THORACOPLASTY WITH SPECIAL REFERENCE TO THE ADVANCED CASE

By HARVEY J. BEARD

From the Kelling Sanatorium, Holt, Norfolk

THIS study is based upon 100 consecutive cases of thoracoplasty for plumonary tuberculosis, exclusive of empyema cases, operated on from April 1946 to January 1950 in Kelling Sanatorium.

The policy adopted throughout has been to refuse no patient a thoracoplasty when it has been felt that he would derive benefit from the operation. Inevitably this means that many cases accepted for operation have little chance of becoming sputum negative. If these cases are sufficiently improved in health to work, then an operation is worth while.

The theory of cavity closure accepted is that where the draining bronchus is closed first and the operation practised is based on the Price Thomas (1942) modification of Semb's (1935) original operation.

The majority of operations are performed under local or epidural anaesthesia. Blood transfusion is not a routine measure, but is given when required. Bronchoscopy is performed pre-operatively if endo-bronchial disease is suspected. Streptomycin became available for the later cases.

Patients are selected for thoracoplasty following assessment of their condition and mental attitude to the operation. Although there may be extensive tuberculosis and probably cavities in both lungs, the patient is not necessarily considered unsuitable for thoracoplasty. As a preliminary measure pneumoperitoneum is often induced and maintained until operation. Contralateral artificial pneumothorax is postponed for preference until after the thoracoplasty, when the contralateral lung has usually improved rapidly and pneumothorax become unnecessary. It is remarkable how infrequently this lung has deteriorated regardless of the extent of its lesions. Following operation patients are kept in bed for at least three months.

### GROUPING AND RESULTS

In reporting this series three groups have been adopted.

*Group I: The Good Chronic.*—This group comprises quiescent cases of infiltrative lesions in one or both lungs not extensive, chiefly confined to the upper lobe, where the aim is to close a moderate-sized apical cavity (not greater than 4 cm. diameter in the X-ray film), there being no evidence of cavitation in the contralateral lung. These patients will usually remain in good health for long periods when living at home, where they can be allowed to remain while awaiting their turn on the operating list.

*Group II: The Poor Chronic.*—This group includes more extensive disease, probably involving all lobes, with a cavity greater than 4 cm. or even two or

more cavities. Sometimes lesions in the contralateral lung may be extensive and cavitation present even if not seen in the film. Patients in this group may remain stable and in fairly good condition while in sanatorium, but when they return home are liable to periods of ill-health resulting in rapid deterioration.

*Group III: The Deteriorating Chronic.*—In this group are the cases with extensive and more active disease and cavitation, frequently involving all lobes in both lungs, the patient often being confined to bed with a continued elevation of temperature, pulse and sedimentation rates. Patients in this group are not only bad risks because of their lung disease, but in many instances are poor risks for a major operation.

In grouping cases not only is the extent and quality of the pulmonary lesions assessed, but the patient's age, general condition, and length of the tuberculous history are also taken into account.

The average first hour B.S.R. reading for Group I was 9, the highest was 33, being the patient who died (death No. 3). For Group II the average was 21 with a maximum reading of 70, and Group III, 31 with 100 as the highest figure.

Of the 100 cases 2 were bilateral thoracoplasties, one a revision operation, and in all there were 249 operation stages. Forty-four were primary thoracoplasties; 38 had an artificial pneumothorax tried; these include those cases where a pneumothorax was induced but abandoned after thoracoscopy in favour of thoracoplasty; 18 cases had had a previous pneumothorax extending from a few months to several years. A pneumoperitoneum preceded 15 of the thoracoplasties. It is interesting to note that 9 of the patients had been discovered by mass radiography, and thoracoplasty represented their initial treatment. One case was complicated by known diabetes.

TABLE I.—AGE GROUPS

Age (years)				No. of Patients
15-20	..	..	..	8
21-30	..	..	..	50
31-40	..	..	..	38
41-50	..	..	..	4

The youngest 18, the oldest 49.  
Males 78. Females 22.

Patients came from both urban and country districts, and prior to the introduction of the National Health Service were drawn from a wide area—Norfolk, London, Lincolnshire and Yorkshire. The occupations, as would be expected, varied considerably, including members of labouring, clerical, technical and professional classes.

TABLE II.—THE SIDE OPERATED ON AND THE NUMBER OF RIBS REMOVED

	No. of Cases	Ribs resected							
		2	3	4	5	6	7	8	10
Right ..	45	1	2	1	14	2	15	6	4
Left ..	57	1	0	0	12	3	26	9	6

Two were bilateral cases.

TABLE III.—THE RESULTS ACCORDING TO THE THREE GROUPS ADOPTED

	<i>No. of Cases</i>	<i>Deaths</i>		<i>Sputum-negative Cavities Closed</i>	<i>Sputum-positive Improved</i>	<i>No Improvement</i>
		<i>Immediate</i>	<i>Late</i>			
1. Good Chronic ..	26	1	0	24	1	0
2. Poor Chronic ..	60	2	2	39	16	1
3. Deteriorating Chronic	14	3	3	3	4	1

The state of the sputum is that on the discharge of the patient from sanatorium, and sputum-negative means there have been repeated specimens examined by both direct smear and culture.

The results as a whole show that of the 100 cases 11 have died, 7 deaths being attributable to operation. There are 66 with negative sputum and in whose X-ray film cavities are no longer visible. There are 21 remaining-sputum positive but improved, and 2 show no improvement.

The figure of 66 per cent. converted to sputum-negative reveals the effects of operating on many poor and deteriorating cases, a procedure considered fully justified by the marked improvement which has ensued.

Deaths have been separated into immediate, taking place within three months of operation, and late, taking place after three months.

TABLE IV

<i>Deaths</i>	<i>Cause of Death</i>	<i>Time Post-operative</i>
Immediate (within three months of operation)	1. Shock	$\frac{3}{4}$ hour
	2. Shock	1 $\frac{1}{2}$ hours
	3. Paradoxical respiration	40 hours
	4. Pulmonary tuberculosis and wound infection	7 days
	5. Thrombosis	11 days
	6. Pulmonary tuberculosis and wound infection	3 months
Late (over three months after operation)	7. Chronic pulmonary tuberculosis and tuberculous wound infection	6 months
	8. Tuberculous broncho-pneumonia	8 months
	9. Chronic pulmonary tuberculosis	1 year
	10. Tuberculous meningitis	1 year 10 months
	11. Chronic pulmonary tuberculosis	2 years 7 months

The third death was the most disturbing, being a Group I patient, a female, following a two-rib second stage. The cause of death is not satisfactorily explained and post-mortem examination was refused by the relatives. The remaining deaths were all from Groups II and III. Case 1 was a bilateral thoracoplasty. In case 5 the innominate vein was injured. In case 7 a pulmonary cavity was inadvertently opened and resutured. Streptomycin was not then available and tuberculous wound infection followed.

Table V concerns the condition of the contralateral lung where there was either an artificial pneumothorax present or where its disease was extensive, or had shown activity within the three months before operation. In all cases not included in this table the contralateral lung gave rise to no anxiety, though it usually contained disease.



TABLE V.—THE CONDITION OF THE CONTRALATERAL LUNG AS JUDGED BY CLINICAL AND X-RAY EXAMINATION

		No. of Cases	Sputum- negative Cavities closed in Both Lungs	Sputum- positive Improved	No im- provement	Dead
Active or extensively Diseased	No cavity detected	20	14	3	0	3
	Cavity present ..	16	6	5	2	3
Contra- Lateral A.P. present	No. cavity detected	11	9	1	0	1
	Cavity present ..	5	1	4	0	0

Included in the "Extensively diseased, no cavity detected," class is the bilateral thoracoplasty with a fatal result.

All these cases were from poor or deteriorating groups. Table V shows that of the 74 cases comprising these two groups (Table III), in 52 the contralateral lung had either extensive disease or an artificial pneumothorax prior to operation. Of the 11 cases with a contralateral pneumothorax and no cavity detected only 5 could be said to give rise to no anxiety about the operative procedure. In the remaining 47 cases the condition of the contralateral lung gave occasion for concern. The majority of these patients showed radiological evidence of disease in all lobes of the contralateral lung.

The "Contralateral lung, active or extensively diseased," class consists of 36 cases of which 20 have been rendered sputum-negative. Only on four occasions has it been considered necessary or advisable to induce a contralateral pneumothorax following the operation. In three of these negative sputum and healing has been achieved, but in the fourth case, even after extensive adhesion section the cavity continued to enlarge; although the thoracoplasty lung cavity was closed this is considered a case of no improvement. The other cases remaining sputum-positive had so much contralateral lung infiltrative disease that pneumothorax, even if it were possible, was considered dangerous, or the thoracoplasty lung because of its extensive disease and cavitation was not made sputum-negative. In this class are most of the gravest risk cases that were undertaken, and deaths 1, 2, 4, 7, 10 and 11 were amongst them.

The class "Contralateral artificial pneumothorax present" is sharply divided. Where no cavity was present 9 out of 11 became sputum-negative, whereas only one is sputum-negative out of five with a known cavity in the contralateral pneumothorax lung. The decision whether or not to operate on patients in this class was often difficult to make. Only one case had an adhesion-free pneumothorax. Others had had the lung freed as far as possible in this or other institutions. Several had extensive disease and a thickened pleura with poor lung expansion on respiration. Six cases had well-marked areas of atelectasis amounting apparently to a complete lobe in three. Two others had poor pneumothoraces of several years' duration with numerous adhesions, thickened pleura and collapsed areas; neither had had a thoracoscopy performed. Both did well following thoracoplasty, but one is still sputum-positive.

Included in the 16 cases in this class are 5 with bilateral disease where it was considered essential to do a contralateral pneumothorax before proceeding with the thoracoplasty. Death No. 6 was amongst these.

Many cases classed in Table V present the problem of deciding how much thoracoplasty collapse can be undertaken. The extent to which the contralateral lung and its pleura are affected frequently limits the operation to avoid leaving the patient a respiratory cripple.

#### COMPLICATIONS ENCOUNTERED IN THE SERIES

In the Group I cases there has been an almost complete absence of serious complications, except for one extra-fascial space hæmorrhage. Other complications were in Group II and III cases.

Transient atelectasis is so common in some degree after thoracoplasty that it can only be considered a complication when it gives rise to symptoms. There has been one case of toxic atelectasis which re-expanded after eight months.

Wound infection was a troublesome problem earlier in the series. In three infections the cases were known beforehand to be penicillin-resistant staphylococcal carriers, two from mild chronic middle-ear disease, and the third from an ulceration of the hand of tuberculous origin. There were seven serious infections involving the muscle planes or extra-fascial space, and all appeared after the second or subsequent stage. One case two and a half years after operation still shows an intermittent discharge from a sinus. In the first infections the organism, *Staphylococcus aureus*, was penicillin-sensitive. After this penicillin was given to every case post-operatively. Some four months later a second wave of infection occurred and the same organism was found in all to be penicillin-resistant. Routine penicillin was then discontinued.

When operating on bad cases the risk of infection is greater. Not only are these cases more susceptible to infection, but they are the cases which require an extensive extra-fascial dissection to mobilise the lung.

During this series of operations repeated and exhaustive bacteriological investigation failed to show any source of infection. A thoracic surgeon who had been confronted with similar sepsis suggested that after washing-up for operating the fingers be dipped into a 1 per cent. solution of iodine in 70 per cent. ethyl alcohol; this appears to be meeting with success, over forty thoracoplasties beyond this series having been completed without infection.

Tuberculous wound infections have twice been seen, in the case referred to under Table IV, and in a second patient who ten months after a thoracoplasty without incident developed in the wound scar a tuberculous sinus which led up to the subscapular region. This healed with streptomycin given intramuscularly.

Pleural effusion of the contralateral side occurred in two cases, both slight, and both patients regained full chest-wall movement. Recrudescence of an old lesion in the contralateral lung was noted on three occasions, all of which subsided. There was a massive spread to the other lung in one Group III case, but this settled with streptomycin; the second stage had to be postponed for six months.

Thrombosis of the brachial vein was diagnosed three times; each subsided within three weeks.

Mental deterioration followed an otherwise successful operation early in the series. The patient had not disclosed a previous spell in a mental home or his similar family history. He is still an inmate of a mental hospital.

#### PHRENIC CRUSH FOLLOWING THORACOPLASTY

Phrenic crush on the same side has been found of value in a number of cases where the sputum has remained positive for several months after the thoracoplasty. It was performed in seven instances with, in five, the addition of a pneumoperitoneum.

#### FOLLOW-UP OF CASES

All cases in the three groups have been followed up and all deaths recorded. The Group I case discharged with a positive sputum has since become negative, and five others from Groups II and III are also reported as having become negative since discharge. Two more Group II cases with positive sputum have recently had a re-operation thoracoplasty followed in one by a phrenic crush; both are sputum-negative. Only two cases have up to the present had to be readmitted because of deterioration in the contralateral lung.

Looking back I find that, of the 74 cases comprising Groups II and III, 6 would now be considered for pneumonectomy because of a destroyed lung. Of these 6, 2 remain sputum-positive.

#### GENERAL CONSIDERATIONS OF RESULTS

To assess the results of thoracoplasty in these cases with extensive disease in one or both lungs is not easy, and a number of guides must be taken into account. A repeated negative sputum even if cultured is no final criterion of arrested disease, as an occasional positive may be found at long intervals. It is only possible to assume that healing has taken place when with the passage of years the patient remains in good health with a persistently negative sputum and no X-ray evidence of deterioration.

This series of 100 cases is too recent to estimate fully the value of the results. Encouragement for the long-term results can be obtained from reference to authors with long experience. Holmes Sellors (1947) quotes 59 per cent. of 633 thoracoplasties as working full-time and 516 were known to be alive. Nyström and Kirnmann (1948) reported 95 thoracoplasties done between 1914 and 1929, of whom 30 still survived, several twenty-five years after operation. An earlier series of 181 thoracoplasties reported by Meltzer (1941) had the high rate of 79 per cent. sputum-negative, these including cases with considerable bilateral disease.

The results of thoracoplasty in good risk cases are excellent. In this series twenty-four of twenty-six (92 per cent.) are sputum-negative and have a good prognosis. All are known to be well and if not working are fit for work.

The "poor chronic" group, the largest, shows 60 per cent. are sputum-negative, and although the outlook is more uncertain it is in many cases almost as good as Group I.

The small "deteriorating" group with a sputum conversion of 21 per cent. presents a very difficult problem. Is the operation justifiable? I believe that it is. All patients in this group will die unless something is attempted, and those desiring operation should be given that chance if there is some prospect of success, for they are more liable to infect others and later when bedridden are a greater economic liability. Of the 14 cases in this group 2 have a prognosis almost equal to the first group and others are living useful lives. In operating on many patients from Groups II and III there was nothing to lose, the early prognosis being either grave, or in those who were chronic invalids ultimately hopeless.

From the results of this series and the experience gained we feel it worth continuing in the policy of accepting these advanced cases for thoracoplasty.

### Summary

1. One hundred consecutive cases of thoracoplasty are grouped and the results discussed.

2. The "good chronic" group, with a cavity not exceeding 4 cm., shows 92 per cent. sputum negative; the "poor chronic" group, the largest, 60 per cent.; and the small "deteriorating" group, 21 per cent. sputum-negative on discharge from sanatorium.

3. The application of the operation to patients with extensive disease in one or both lungs is examined and advocated, even though a perfect result cannot be achieved.

I wish to thank Dr. G. Ivor Davies, physician superintendent, and Mr. E. C. Wynne-Edwards, consultant thoracic surgeon, for their kind permission to publish these cases.

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NYSTRÖM, G., and KIRNMANN, E. (1948): *Act. Tuberc. Scand.*, **22**, 1.  
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But alas! Physicians have very seldom an Occasion to give their Advice about preventing this Distemper, (when in the Beginning perhaps it may be cured as well as other Diseases, although for the most part by Neglect it proves fatal) the sick Persons seldom imploring *Aesculapius's* Help, before the Distemper has run on so far as to be a fatal Case, and then they in vain expect Miracles from the Art of Physick, when it is more convenient for them to have the good Counsel of a Minister about the future Salvation of their Souls, and the Advice of a Lawyer about making their Last Will.

MORTON, RICHARD: *Phthisiologia: or, a Treatise of Consumptions*, London, 1720, p. 67.

## OPEN SAFETY PINS IMPACTED IN THE ŒSOPHAGUS

### A DESCRIPTION OF CASES

By N. ASHERSON

From the Royal National Throat, Nose and Ear Hospital

THIS paper records five separate episodes in each of which a metallic foreign body was swallowed. In two of the incidents an open safety pin, point upwards, impacted in the upper third of the œsophagus, and was removed by œsophagoscopy. In the third, a pin was swallowed and inhaled into a peripheral posterior right lower lobe bronchus; this was some days later coughed up. In each of the fourth and fifth incidents, the foreign body was swallowed and passed through the œsophagus and was eventually passed via naturales.

The following five successive episodes occurred within a period of months.

#### *Episode 1. (Figs. 1, 2 and 3.)*

A girl of 19 in an institution swallowed an open safety pin point upwards: the foreign body impacted at the level of the arch of the aorta. It was successfully removed by œsophagoscopy under anæsthesia, by traction on the clasp of the pin. The foreign body was forcibly removed owing to difficulty associated with the anæsthesia. The wall of the œsophagus must have been abraded, but recovery was prompt and completely uneventful.

Figs. 1 and 2 show the antero-posterior and oblique views of the pin: Fig. 3 shows the pin after removal: note the traction exerted on removal has forced the pin further open.

*Comment.*—On each occasion the pin lodged at the same level—the arch of the aorta. If deglutition is observed on the screen by means of swallowed opaque boli, the latter will be observed to leave the oropharynx, whence it is propelled, at lightning speed, like a projectile, until it reaches the level of the arch of the aorta, *when it is momentarily halted* before passing on more slowly. This has been established by Russel Reynolds in his X-ray studies of deglutition. The pin cannot be passed on, as any annular peristaltic constriction of the œsophagus at the level where the point is in contact with the œsophageal wall would lead to its being more tightly held.

#### *Episode 3. (Figs. 7 and 8.)*

This time, a few weeks later, the same patient swallowed an ordinary pin which was inhaled into the air passages, lodging in the peripheral posterior right main lobe bronchus, the point being upwards.

Within forty-eight hours it was *expelled spontaneously per vias naturales during a bout of coughing.*

In another case under my care, an adult man swallowed and inhaled a two-inch nail which lodged in the right main peripheral bronchus. Some twelve



# PLATE XVI.



FIG. 1.—A.-P. VIEW.



FIG. 2.—OBLIQUE VIEW.

Open safety-pin impacted in thoracic-oesophagus.

EPISODE 1.



FIG. 3.



FIG. 4.—A.-P. VIEW.



FIG. 5.—OBLIQUE VIEW.

EPISODE 2.



FIG. 6.

Another open safety-pin impacted in same situation in same patient 17 days later.

PLATE XVII.

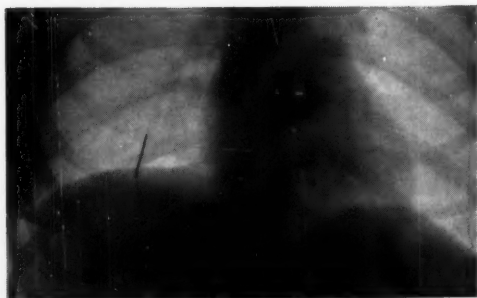


FIG. 7.—EPISODE 3, ANTERO-POSTERIOR VIEW.

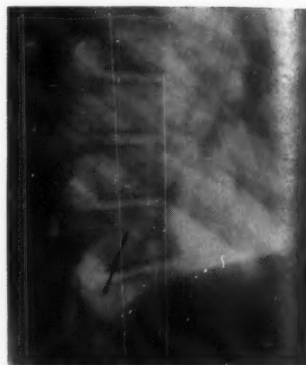


FIG. 8.—EPISODE 3, OBLIQUE VIEW.



FIG. 9.—EPISODE 4, SWALLOWED CRUCIFIX.

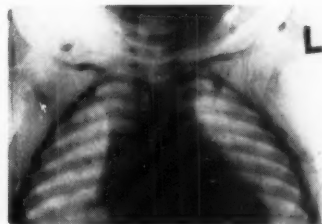


FIG. 10.—EPISODE 5, SWALLOWED CLOSED SAFETY PIN.

(These both passed *per vias naturales*)



11.4.39



13.4.49

FIGS. 11. and 12.—SAFETY PIN IN TRACHEA.

hours later he gave a violent cough, and the nail was violently projected out through his mouth across the ward.

*Comment.*—The spontaneous expulsion of a pointed foreign body lying loosely in a lower main bronchus is always possible. It is probable that if the patient were held head up and made to cough the expulsion could be expedited, though this is no alternative to removal by a bronchoscopy where available. To precipitate a paroxysm of coughing the patient should be made to take a few deep breaths of mustard gas—a manoeuvre used as a routine by the late Sir James Dundas Grant to secure sputum for testing for tubercle bacilli in a patient suspected of pulmonary tuberculosis.

*Episodes 4 and 5. (Figs. 9 and 10.)*

In two successive subsequent occasions the patient swallowed a crucifix, shown in the colon (Fig. 9), and a closed safety pin (Fig. 10), shown in the colon.

This case was referred to me by Dr. J. K. C. Laing and Dr. J. M. Crawford, and I am obliged to them for enabling me to make use of this case record.

The following case is added to show that in the trachea a closed safety pin may lodge at the same level.

A CLOSED SAFETY PIN IN THE TRACHEA

An infant eighteen months old swallowed a safety pin. There was no cough. The infant was well. The X-ray (Fig. 11) showed the closed safety pin at, be it noted, the same level of the safety pin in the previous case—at the arch of the aorta. This coincides with the level of the bifurcation of the trachea.

The safety pin was assumed to have lodged in the œsophagus, but œsophagoscopy failed to locate it, and it was assumed that the intruder had passed on into the stomach.

A second X-ray (Fig. 12) taken two days later showed the pin at the same level, again situated with its long axis parallel with the trachea, but now it had rotated in its long axis and was located in the trachea, the lower end of the pin resting on the carina.

The infant was well; there was no cough, no tracheal slap or thud on coughing, no wheezing; temperature and pulse normal. The pin was *in situ* five days in all.

The pin was removed by bronchoscopy in a few seconds under chloroform anaesthesia using the infant's bronchoscope and peanut forceps, the pin being rotated to bring its long axis in line with the line of the vocal cords for withdrawal. The upper end was seen with difficulty, as it resembled the glint of mucus.

The closed pin was 4 cm. long and 1 cm. at its maximum width.

*Comment.*—The alignment of the closed safety pin: the level at which the lower end rests: the rotation of the pin, the level remaining constant—all these locate the foreign body in the trachea. If it were in the œsophagus it would be on the slant and move nearer on, not rotate.

There are no secondary lung changes as would be expected.

## THORACOSCOPY AND AIDED BREATHING IN THE DYSPNŒIC PATIENT

By MICHA KONSTAM AND M. P. SHERWOOD

From the King George V Sanatorium, Godalming, Surrey

THE establishment of artificial pneumothorax in the presence of gross contralateral disease or extensive contralateral collapse is a recognised form of therapy in selected cases of pulmonary tuberculosis. The inherent risks are naturally greater than those of unilateral pneumothorax, making it imperative to prevent complications as far as possible. One of the most important measures of the collapse programme should be early thoracoscopy and division of adhesions, in order to achieve selective relaxation and avoid the serious pleural complications of the adhesion pneumothorax.

The induction and establishment of an artificial pneumothorax in the type of case under consideration does not, when wisely applied, create dyspnoea. Nevertheless, grave dyspnoea generally arises when at the time of thoracoscopy and adhesion section the patient is subjected to the condition of open pneumothorax. Even a few seconds' exposure of the cannula to the atmosphere may render the patient acutely and dangerously anoxic.

The measures generally employed to obviate these difficulties are as follows: A contralateral artificial pneumothorax, where present, is deflated to the limits of safety as a preliminary to thoracoscopy on the opposite side. Oxygen is administered through a B.L.B. mask during the intervention, while, in addition, every effort is made to avoid unnecessary exposure of the cannula to the atmosphere by means of thumb pressure or occluding devices. The cannulae are opened only when the telescopes or cauteries are ready and in the optimum position for introduction, and care is taken to introduce these instruments during expiration in order to minimise the sucking-in of air.

Further helpful measures include intermittent or constant deflation of the pneumothorax undergoing thoracoscopy. When dyspnoea is only moderate, it may suffice to interrupt the operation at intervals and to restore satisfactory working conditions by inviting the patient to take a few deep breaths, allowing air to escape through a cannula in expiration, while occluding the cannula in inspiration. Negative pressures are thus temporarily re-established. In the more severe cases, however, it is better to carry out constant deflation through a blunt artificial pneumothorax refill apparatus with the bottles reversed, or, preferably, with an especially introduced catheter connected with a suction pump (R. J. C. Maxwell). Thus excess air is removed and the lung kept in a state of collapse compatible with sufficient aeration, yet leaving sufficient space to the operator to divide the adhesions.

With the pneumothorax deflated during thoracoscopy it is usually possible to divide adhesions, but the set-up is cumbersome and not always foolproof. Overbreathing cannot be entirely overcome, and excessive respiratory excursion, combined with the patient's anxiety and restlessness, adds to the

difficulties. Exaggerated see-saw movement of the cautery on the moving adhesion often broadens the line of cauterisation, and the safety of the operation is much endangered.

To overcome these difficulties one of the writers (M. K.) consulted an anaesthetist (M. P. S.) as to the possibility of controlling dyspnoea during adhesion section by oxygen administration through an anaesthetic apparatus, and the following procedure has been evolved.

When the patient is being told that his adhesions are to be divided it is explained to him that oxygen will be administered during the operation.

Premedication is the same as usually given before thoracoscopy.

The anaesthetic apparatus is shown to the patient in the theatre and its working explained to him. He is told that only oxygen will be administered, and is asked to try to breathe while wearing the mask. Thus he becomes familiar with the smell of the rubber mask before the operation begins. Any re-breathing apparatus with provision for supplying oxygen and for removing the carbon dioxide may be used, but an M. and I.E. circle type anaesthetic absorber was used in all cases under review.

The thoracoscopy is begun and oxygen is administered in the same way as if cyclopropane anaesthesia were being employed.

As soon as air is able to enter or escape from the pleural space, the bag is squeezed slightly at the end of every inspiration; the volume of oxygen thus entering with each breath is larger than in the case of spontaneous respiration.

The most important and difficult part of the procedure lies in the timing: it is essential that the squeezing of the bag be synchronised with the breathing of the patient, otherwise he experiences extreme alarm and discomfort.

The patient's confidence and full co-operation must be gained at the outset by the foregoing explanation, and he must be frequently reassured throughout the course of the operation.

Nine thorascopies with adhesion section have been carried out with the help of aided breathing as described. The indications were as follows: Contralateral thoracoplasty in six cases; contralateral hydro- or pyopneumothorax with frozen lung in two cases; and contralateral inexpandable extrapleural hydro-pneumothorax in one case. In each instance the operation was carried out with practically no more difficulty than encountered at pneumonolysis in the unilateral pneumothorax.

### Summary

A procedure is presented which has been found of great value during thoracoscopy of patients with much reduced pulmonary function. No originality is claimed for this method. It was, however, thought worth describing because of the ease with which it enabled hitherto very harassing operations to be performed. The only drawback is the need for an experienced anaesthetist.



## REVIEWS OF BOOKS

*Les Maladies des Bronches.* By JACQUES LECŒUR. Paris: Vigot Frères. Pp. 608. 239 Illustrations.

Dr. Jacques Lecœur has felt impelled to write this book in order to bring the knowledge of bronchial disease in France up to date and in alignment with that of other countries, particularly the United States. There is, in fact, a somewhat American outlook distinguishable throughout the general trend of his discussions of many bronchial conditions.

The author begins this study of diseases of bronchi with a clear and comprehensive description of the microscopic appearances of the various layers which line the walls of the bronchial tubes. He follows with an equally useful discussion of the physiological functions of the bronchi. Strangely enough, the description of the distribution of the bronchi within the thorax, which would appear to be the logical commencement of the book, is not encountered until a later section which deals with the effects of bronchial obstruction. There is, therefore, a lack of cohesion in what would otherwise have been a valuable description of the normal structure and function of the lower part of the respiratory tract.

The clinical part of the book is comprehensive and up to date in so far as it treats of bronchial disease, but it suffers from the fact that the subject is too circumscribed. The author has confined himself somewhat too strictly to the bronchial aspects of respiratory disease and he has, therefore, failed to bring out the very important point that the bronchial tract is merely one part of the whole respiratory apparatus. It is almost impossible, for example, to convey a clear picture of the inflammatory conditions which affect the bronchi without careful consideration of the state of the upper respiratory tract, for sinus infection is recognised as playing a very important part in the pathology of such conditions as bronchiectasis and bronchitis.

The most remarkable omission is the subject of bronchial asthma. While it must be admitted that this condition is not primarily a disease of the bronchi as a rule, the bronchial manifestations are such that the presenting clinical picture is almost entirely concerned with this part of the respiratory tract, and yet there is very little reference in the book to asthma and its management.

Apart from this, the arrangement of the material is excellent and the treatment is comprehensive. The X-ray illustrations are, on the whole, well reproduced, and they demonstrate the points which the author wishes to make.

References are given to the work of many writers both in Great Britain and in the United States. The names of the workers are stated, and their conclusions are quoted, but there is no indication of the source of the information. For the sake of completeness it would be as well to quote the exact references, and this would certainly increase the value of the book.

The index is not altogether helpful. It consists of a recapitulation of the subject matter in the order of its presentation, so that it is not unduly difficult to discover in which section to search for specific information, but it is impossible to locate individual features by reference to the index, and a good deal of trouble is therefore occasioned to the reader.

It has already been made clear that this volume is intended for French thoracic physicians and surgeons, and its object is to embody in the French

literature a comprehensive description of bronchial disease as it is understood at the present time. It is not a book for the students, and there is nothing in the contents which is not already available in a number of standard textbooks which are published in the English language.

J. M.

*New Plombage Materials in Surgical Collapse Therapy of Pulmonary Tuberculosis.* Experimental and Clinical Studies with the Absorbable Gelatin Sponge "Spongostan" and the Non-absorbable Polyethylene Sponge "Polystan-Sponge." By JENS BING, E. HART HANSEN, KARL LINDEN AND ERIK VON ROSEN. (Supplementum XXV, Acta Tuberculosea Scandinavica.) Copenhagen: Ejnar Munksgaard, 1951. Pp. 151, 88 figs.

The history of plombage, recounted here, from paraffin in 1913 to Lucite balls, is not a happy one; but the authors detail their experiences (over some eighteen months) with two new foreign bodies—an absorbable gelatin sponge "Spongostan" and a non-absorbable polyethylene sponge "Polystan-Sponge." The former resembles the gelatin sponges used in hæmostasis, and swells as it takes up fluid during the first two to three weeks in the tissues, before being itself absorbed after some four months; while the latter, light, non-irritant and easily moulded to form, remains as a permanent encapsulated "plombe," anchored in place by invading fibroblasts.

The 113 operations since January 1949, in which first "Spongostan" alone and then a combination of the two were employed, comprised patients with apical tuberculosis suitable for treatment by extrapleural pneumolysis or thoracoplasty, and also those with basal cavities or cavities persisting after thoracoplasty. It was found that a mould of "Polystan-Sponge" wrapped in sheets of "Spongostan," and placed either extrapleurally or outside the stripped periosteum and intercostals, produced an excellent selective collapse, afterwards mitigated as the gelatin sponge absorbed, leaving permanent polyethylene. In a quarter to a third of all cases the stage of swelling was accompanied by a discharge of bloodstained serum from the wound, and this was sometimes both persistent and profuse.

Six deaths occurred, mostly from spread of the disease, and four cavity perforations, three being operative and one late; but infection in general was adequately controlled by antibiotics. The patients have not been sufficiently long observed to judge comparative results or late complications.

G. F.

*Pioneer Doctor.* By LEWIS J. MOORMAN, M.D. Norman: University of Oklahoma Press. 1951. Pp. 252. Price \$3.75.

In this personal survey of over fifty years of medical practice Dr. Moorman's warm human approach is never absent, so that his book, in spite of irritating flaws of style, is essentially readable for both doctor and layman. The life of an impecunious doctor on the plains of the Middle West before the advent of civilisation or science is far removed from the intense specialisation and high pressure of the modern consultant, but it is significant that the doctor-patient relationship remains the guiding principle of Dr. Moorman's career and is no doubt largely responsible for his success and popularity.

In spite of the satisfaction to be obtained from caring for those who had no alternative medical care, Dr. Moorman left the plains after some ten years and continued his medical studies in Vienna. The chapters covering this period present him with the opportunity of depicting medical personalities through the

ages, but with such inevitable brevity that it will probably not appeal greatly to the medical reader. On his return to the United States he decided to specialise in pulmonary tuberculosis. This disease has "a peculiar moral, social and economic appeal which has stimulated universal interest," and one can readily appreciate how Dr. Moorman found satisfaction in its manifold aspects. In this book he returns again to his theory of tuberculosis conditioning the lives of its victims, and although one may disagree with his conclusions that, for example, Cecil Rhodes's empire building was directly attributable to his pulmonary disease, or that Cicero's hæmorrhage necessitated travel and rest which ultimately matured the whole man, this part of the book is interesting for the thumb-nail sketches of great men of the past and certainly gives food for thought.

Readers of this Journal will probably find the section on sanatorium life and management of the tuberculosis case most valuable. While there is no very startling innovation in the régime Dr. Moorman practises, his emphasis on the psychological aspect and of the necessity for viewing the patient as a whole should be chewed and inwardly digested. Dr. Moorman is pre-eminently "the physician who loves people." He must have been among the earliest to foresee the potential dangers of over-specialisation and a narrow outlook, and his faith in general practice, in the vital place of the family doctor in the life of the community and his relationship to medical undergraduate teaching, is stimulating and encouraging.

He is to be particularly commended in the way he presents the symptoms, signs and treatment of tuberculosis to the lay reader—without being alarming he pin-points the danger signals and explains the possibilities for cure. He has undoubtedly a vocation for his chosen career and he transmits this enthusiasm to his reader. The sanatorium as his own "workshop and a friendly haven for the patient" epitomises the entire book.

B. S.

*Medical Treatment, Principles and their Application.* Edited by GEOFFREY EVANS, M.D., F.R.C.P. London: Butterworth and Co. 1951. Pp. 1,398, 51 figs. Price £5 5s.

It is always difficult to separate diagnosis from treatment, but Dr. Geoffrey Evans has, with the assistance of over fifty experts, edited a comprehensive work covering almost every sphere of treatment in general medicine. He has undoubtedly succeeded in his object, which is "to reflect the present-day outlook on medical practice and to make generally known the details of the treatment of sick persons and their diseases, as practised by the contributors to the book."

The volume is well produced, very readable, and will prove in the main a valuable compendium on most facets of treatment in general medicine.

Readers of this journal will be particularly interested in the section on diseases of the chest by Dr. Robert Coope. He describes with extreme lucidity most aspects of treatment of the acute and chronic chest diseases. The joint contribution on pulmonary tuberculosis by Dr. Coope and Mr. C. Price Thomas is an innovation that produces, as one would expect, an admirably balanced achievement which will please the reader and constitutes a precedent worthy of emulation. The chapters on allergy, including hay fever and asthma, by Dr. C. J. C. Britton; on the antibiotics, by Dr. F. C. Q. Valentine; and cardiovascular disease, especially pulmonary heart disease, by Dr. Paul Wood, are particularly useful and practical for those interested in chest conditions.

On the other hand, the reviewer feels that this important section of the

book would have been improved by X-ray illustrations and perhaps also line diagrams. The paucity of illustrations through the whole of the book, even though its scope is confined to treatment, is one of the features which might be corrected in future editions. The sections which are adequately illustrated—namely, those of children's diseases, dental sepsis, thrombosis in the veins and radium therapy—are enhanced by a more vivid presentation.

There are, inevitably, some omissions and inadequacies—for example, half a page only is devoted to sarcoidosis, limited to the section on skin diseases in spite of its widespread nature. On the other hand, the chest physician will find in the section on children's diseases by Dr. Reginald Lightwood a good survey of the treatment of abdominal tuberculosis, tuberculous cervical adenitis and meningitis, as well as of upper respiratory tract infection, and the recurrent problem of tonsils and adenoids and its management.

The task of bringing together over fifty authorities and the further difficulties arising from the present-day time lag between completion of the manuscript and publication of the book have inevitable repercussions. The editor is, however, certainly to be congratulated on his achievement, particularly in his avoidance of repetition and overlapping, and in spite of its high cost the work will undoubtedly take its place as a valuable reference book and one of the best available books on therapeutics.

P. E.

*Tuberculosis in Iceland.* Epidemiological Studies by SIGURDUR SIGURDSSON: Medical Director of Tuberculosis Control, Iceland, and Director of the Health Centre, Reykjavik.

The problems associated with the epidemiology of tuberculosis have long been recognised, and it is only by painstaking research into the evolution of the disease and by carefully planned mass surveys that real light can be thrown on the magnitude of the problem to enable practical steps to be taken to deal with it.

Dr. Sigurdsson's studies provide valuable information along these lines which should be interesting and useful to tuberculosis workers in every country. From historical and statistical records together with information obtained from tuberculin surveys and comprehensive mass surveys, recorded against a background of geographical and population characteristics, a picture is drawn of the natural history of tuberculosis in Iceland from the earliest times to the present day.

The account up to 1911 is based on scant evidence and is somewhat conjectural, but from then onwards adequate statistical records are available. These have been carefully sifted and analysed, and show that the morbidity and mortality which reached a peak in the early 1930s have been falling steadily ever since. Allowing for improved living conditions and immunological changes, this decline in morbidity and mortality appears to reflect the improved tuberculosis control.

The mass surveys of twelve districts carried out from 1941 to 1945 were nearly 100 per cent. complete and covered 47 per cent. of the total population. Previously unrecognised cases discovered by the survey constituted 2.4 per 1,000 in eleven districts (excluding Reykjavik) and 1.6 per 1,000 in Reykjavik. Other conclusions reached are generally in accord with workers in other countries, notably the fact that tuberculous infection is occurring later in life than it did ten to twenty years ago.

The absence of bovine tuberculosis is particularly noteworthy.

It is interesting to note that extensive B.C.G. vaccination is planned, and bearing in mind that already in the last twenty years the mortality has been reduced from more than 200 per 100,000 of the population to 26 per 100,000 in 1949, it is at least within the bounds of speculation that tuberculosis may be completely controlled in what is a comparatively small and isolated community.

J. H. P. J.

*Design for Sanatoria.* N.A.P.T. 1951. Price 12s. 6d.

The report just published by the National Association for the Prevention of Tuberculosis entitled "Design for Sanatoria" is a sober testament of good counsel and sound common sense, and the intention behind it is that it should be a guide for all concerned in the planning of sanatoria. Its simplicity and directness are exemplary. The individuals concerned and experts consulted were chosen to represent all aspects of the problem, and in the absence of any minority report one is brought to the conclusion that all the points raised in this report therefore carry the full agreement of these authorities, who hope that "if the basic ideas of sanatorium care are properly understood, the structure which is built on such foundations will fulfil its requirements."

The range of this report is complete—from wards to weir overflows, the size of sanatoria and sites to "smalls," aspect and balconies to hot-water bottles and door-knobs. To have attempted so much in this report is both its strength and weakness.

From the planner's point of view, when it comes to its application, the strength is there for all to approve; the weaknesses to criticise. Such criticism must be directed at the unevenness of the guidance given under some of the many headings, the failure to distinguish between unsolved problems in policy and planning and matters in which common experience can justifiably be called upon to utter authoritative judgment. Thus, in the all-important matter of the ward units, dealt with in five short statements (sections 49-53), general statements are made, and we are advised that the governing principle must be the number of patients which can be satisfactorily supervised by one sister or charge nurse.

To apply this principle would mean that the planner must know what satisfactory supervision is and must assume that all sisters and charge nurses are equally capable. The probability is that the problem of the design of ward units requires more consideration than the views of a mixed group of lay members and experts, and it is suggested that further inquiry and scientific analysis of the first principles, similar to that being undertaken by the Nuffield Provincial Hospitals Trust, on behalf of the acute sick is urgently necessary to help some of the conflicting requirements of the T.B. patient, the nurse and the doctor, and particularly the interest of the man who pays the bill too.

For many years the rule of thumb which has given the space provided for a patient has been 90 square feet in a single room, and in other rooms an area of 80 square feet per bed. No authoritative statement has yet been made whether this is adequate and what other facts, such as the amount of warmth, light and air, are most conducive to the rate of improvement in the patient's health. This is doctor's work, and a statement on these factors is long overdue.

It may or it may not be possible for the planners to provide the best accommodation, but in aiming to improve standards more factors on the basic requirements will be necessary.

S. E. T. C.



## BOOKS RECEIVED

- Die Tuberkulose. Ihre Erkennung und Behandlung.* By Hellmuth Deist and Hermann Krauss. Stuttgart. 1951. Pp. 754. DM. 68.
- Arquivos da Universidade da Bahia.* Faculdade de Medicina. Volume IV. 1949.
- NAPT Handbook of Tuberculosis Activities.* 13th Edition. 30s.
- Pneumoconiosis.* Edited by Arthur J. Vorwald. Cassell and Co., Ltd. 57s. 6d.
- Health Horizon.* Edited by Harley Williams. Quarterly, 2s.; 7s. 6d. a year.
- St. Thomas's Reports.* Second Series. Volume VI. Pp. 285.
- Tuberculosis Index.* Volume 5, 1950. NAPT.
- Adelaide Children's Hospital.* Volume 2, No. 1. May-November, 1950.



## NOTICES

## INDUSTRIAL INJURIES ACT

PNEUMOCONIOSIS AS AN INDUSTRIAL DISEASE: METHOD OF PRESCRIPTION  
BEING RECONSIDERED

DR. EDITH SUMMERSKILL, Minister of National Insurance, has asked the Industrial Injuries Advisory Council to consider further the question of the method of "prescribing" pneumoconiosis as an industrial disease under the National Insurance (Industrial Injuries) Act, 1946—i.e., how the classes of insured persons eligible for benefit for the disease should be defined.

Pneumoconiosis is at present "prescribed" in relation to insured workers in a number of occupations which are known to give rise to a risk of the disease. These occupations include stone and granite quarrying and masoning, sand blasting, pottery manufacture, metal grinding, steel fettling, coal and certain other forms of mining, coal trimming and slate dressing.

The Council's Industrial Diseases Sub-Committee under the chairmanship of Sir Wilfrid Garrett, who is also chairman of the Advisory Council, are now reviewing the present method of prescribing pneumoconiosis. They will consider such possible alternatives as prescribing the diseases generally for all insured workers, or by reference to occupations involving exposure to concentrations of specified dusts. The committee may also reconsider the definition of pneumoconiosis for this purpose. It is at present defined as "fibrosis of the lungs due to silica dust, asbestos dust or other dust, and includes the condition of the lungs known as dust-reticulation."

## WORLD HEALTH ORGANISATION

THE SHORTAGE OF NURSING PERSONNEL IN TUBERCULOSIS  
INSTITUTIONS

The World Health Organisation's Expert Committee on Tuberculosis has produced a valuable report on the shortage of nursing personnel in tuberculosis institutions (WHO/TBC/36. Rev. 1, April 11, 1951). The report is summarised below and references to further sources are given at the end of the actual document.

The rapid expansion of tuberculosis programmes and the development of chemotherapy and chest surgery has increased the demand for nursing services in the institutions, with the result that a long-standing problem has become an acute emergency. Existing institutions are facing the necessity of closing wards and new institutions are unable to function for the lack of these services. There is now a necessity to re-define the function of nursing and to allocate to others those functions which could be carried out by workers in less short supply. This is particularly true for tuberculosis institutions, where many patients are ambulant and their needs for nursing service are relatively few.

The National Tuberculosis Association and National Nursing Associations of the U.S.A. published a report in 1938 whose schedule of nursing hours for the different types of patients is here summarised and remains an accepted standard for American Tuberculosis hospitals.

The World Health Organisation Expert Committee on Nursing and other committees have put forward various ratios for nurses and auxiliary nursing personnel. It is urged that all nurses should be given a basic training in tuberculosis nursing, and that training institutions which can offer facilities for a complete course are at an advantage in securing staff. They should also offer courses in tuberculosis nursing to graduate nurses who have not had a basic training in this subject, as well as to auxiliary nurses who will constitute the major group of nursing personnel.

The recruitment of male nurses and orderlies and ex-patients of both sexes has proved a valuable source in many countries, and part-time workers offer a further supply that can be tapped. One of the principal deterrents to recruitment is the fear of infection. This can and should be countered by available protective medical measures which should be given wide propaganda. The actual workers are the best source of recruitment, so that a well-supervised and trained staff will recruit its own replacements.

Institutions "located near the centres of population" can more readily acquire staff and can arrange for shift work, part-time workers and non-residential staff. The smaller dramatic appeal of tuberculosis nursing as compared with that of acute general nursing should be compensated by a full partnership between doctor, nurse and ancillary worker and an appreciation of the psychiatric problems involved.

Higher pay than for general nursing does not seem to be of more than temporary advantage in recruitment, but staff accommodation is of the utmost importance.

The final recommendation of the World Health Organisation is to urge member Governments to undertake (or continue) a study of:

- (i) the existing supply of each type of nursing personnel;
- (ii) the estimated number of each type of personnel needed;
- (iii) the factors which interfere with securing candidates for training of various types;
- (iv) the effectiveness with which nursing services are used.

## MINISTRY OF HEALTH

### DRAMATIC FALL IN T.B. DEATHS—BIGGEST ANNUAL DECREASE FOR TWENTY-ONE YEARS

DEATHS from tuberculosis in England and Wales fell by 20 per cent. last year, the biggest fall recorded for any one year since 1929.

The death rate per million for respiratory T.B. last year was 321, compared with 403 in 1949.

Reviewing the position since the National Health Service started, Mr. Marquand, Minister of Health, stated recently:

"We have provided 3,550 extra beds for the treatment of tuberculosis in the first two and a half years of the service, and recruited 1,500 extra nurses to the staffs of sanatoria and tuberculosis hospitals. But the really important advance has been in methods of treatment. We think we have considerably improved the quality of specialist service in this field and added methods such as use of beds in general hospitals and home treatment. Fortunately, just at this time, too, new drugs—streptomycin and P.A.S.—came along.

"Now, in the mortality figures for 1950, we see the first dramatic improvement. In 1949 the death rate per million for respiratory tuberculosis was 403 (516 for men and 301 for women); in 1950 the figure was 321 (422 for men and 227 for women). This represents a reduction of 20 per cent. in one year—the biggest annual reduction since 1929, the earliest year for which comparable figures exist.

"Preliminary figures so far this year for the great towns in England and Wales show that this striking improvement continues. For the first twenty weeks of the year deaths totalled 3,712, compared with 4,138 in the same period a year earlier. This is a reduction of nearly 10 per cent. and has occurred despite the winter influenza epidemic.

"Notifications have fallen, too, and at last the sanatorium waiting lists are going down."

Mr. Marquand was speaking at the dinner given to mark the twenty-first anniversary of the Socialist Medical Association.

### NAPT SCHOLARSHIPS FOR SCOTTISH NURSES

THE following scholarships of £150 each will be awarded by the Scottish Branch of the National Association for the Prevention of Tuberculosis during the year 1951-2:

(1) *NAPT Scholarship for Scottish Nurse*

For a registered female nurse working at the time of her application in a hospital in Scotland.

(2) *NAPT Scholarship for Queen's Nurse*

For a registered female nurse working at the time of her application in Scotland, whose name is on the Queen's Roll of the Queen's Institute of District Nursing. Preference will be given to a nurse working in the Highlands.

The scholarships are tenable for a period of three months for postgraduate study in tuberculosis in hospitals or clinics in (a) the United Kingdom, or (b) Scandinavia.

Candidates should state age, qualifications and previous experience; reasons for wishing to do postgraduate work in tuberculosis; and should affirm their intention to continue in tuberculosis work after attaining the scholarship.

Application should be made to Miss A. J. Weir, Scottish Secretary, NAPT, 65, Castle Street, Edinburgh 2, by September 1, 1951.

### DANGERS OF FOOD POISONING

#### MINISTRY OF HEALTH'S NEW DISPLAY SET

CLEAN FOOD drives throughout the country will be aided by a new Ministry of Health display set on the dangers of food poisoning.

Photographs and coloured sketches show how easily food becomes infected through dirty and careless handling. Unwashed hands are highlighted as the principal source, and there are warnings against germs spread by unguarded coughs and sneezes, by unprotected cuts and sores, and by flies, rats and mice. The main lesson of the set is summed up in the final line—"Always wash your hands before handling food."

Other panels record the case history of a victim of food poisoning and give commonsense preventive measures, including hints on cooking and washing up.

This latest twelve-panel display set is the fifth in the comprehensive series on hygiene being produced by the Ministry with the help of the Central Office of Information for the use of hospitals, factories, local authorities and voluntary organisations.

## THE OXFORD CONFERENCE ON TUBERCULOSIS AND DISEASES OF THE CHEST

JULY 16-21, 1951

PATRON: LORD MORAN OF MANTON. CHAIRMAN: SIR ROBERT YOUNG

### PROGRAMME OF TITLES AND SPEAKERS

#### *Tuesday Morning, July 17.*

Chairman of the Session: Sir Robert Young.

9.15. Short address of welcome by Lord Moran.

"Results of British Mass Radiographic Surveys," by Dr. Norman Smith of the Ministry of Health.

"Tuberculin Surveys," by Dr. Marc Daniels of the M.R.C. Research Staff.

Coffee.

"Vaccination with the Vole Bacillus," by Dr. A. Q. Wells of Oxford and Dr. J. Young of Cambridge.

#### *Tuesday Afternoon.*

Chairman of the Session: Professor Wilfred Gaisford.

"Treatment of Tuberculous Meningitis," by Dr. Honor Smith of Oxford and Prof. R. S. Illingworth of Sheffield.

"Bronchiectasis in Children," by Mr. A. L. d'Abreu of Birmingham.

"Post-tuberculous Bronchiectasis in Children," by Dr. J. H. Hutchison of Glasgow.

#### *Wednesday Morning, July 18.*

Chairman of the Session: Dr. Andrew Morland.

"Present Position of Chemo-therapy in Tuberculosis," by Dr. J. W. Crofton of Brompton Hospital and Dr. L. E. Houghton of Harefield Hospital.

Coffee.

"Present Position of Chemo-therapy" (continued), by Dr. Christopher Clayson of Lochmaben Sanatorium.

#### *Wednesday Afternoon.*

Chairman of the Session: Dr. Peter Kerley.

2.15. "Cardiac Surgery," by Mr. R. C. Brock of Brompton Hospital and Mr. Price Thomas of Brompton Hospital.

Tea.

"Cardiac Surgery" (continued), by Mr. Oswald Tubbs of Brompton Hospital and Mr. Holmes Sellors of the London Chest Hospital.

*Thursday Morning, July 19.*

Chairman of the Session: Dr. John Gibson.

- 9.15. "Pneumoconiosis," by Dr. C. M. Fletcher of the Pneumoconiosis Research Unit.

Coffee.

- "Rehabilitation and Resettlement," by Dr. J. E. Geddes of Birmingham.

*Thursday Afternoon.*

- 2.15. "Pulmonary Resection for Tuberculosis," by Dr. F. H. Young of Brompton Hospital and Mr. Ronald Edwards of Liverpool.

Tea.

- "Pulmonary Resection for Tuberculosis" (continued), by Mr. V. C. Thompson of the London Chest Hospital.

## THE THORACIC SOCIETY

FURTHER details are now available of the Annual General Meeting which is being held at the Physics Theatre, University College, Dublin, on July 13 and 14, 1951.

There is to be a discussion on "Acute Tracheo-Bronchitis" to be opened by Mr. V. E. Negus, Dr. Thomas Anderson and Dr. R. Elsworth Steen on Friday, July 13. There will also be short communications on:

"The Surgical Management of Severe Hæmoptyses of Tuberculous Origin," by Mr. M. D. Hickey.

"Some Results of the Treatment of Tuberculous Cavities with Speleostomy," by Dr. B. O'Brien.

"Some Problems in the Surgery of Mitral Stenosis," by Dr. T. J. C. O'Connell.

On Saturday, July 14, there will be a discussion on "Natural History of Bronchiectasis." Opening speakers: Dr. P. Robertson, introducing Dr. K. Morle, Dr. W. S. Sutton, Dr. C. Strang.

The annual dinner will be held at the Royal College of Surgeons on Friday, at 7 p.m.